Draft Environmental Impact Statement for the Montanore Project

Volume III

Figures

Appendices A through J

Cabinet Mountains *Photo by M. Holdeman*

United States Department of Agriculture
Forest Service
Northern Region

Kootenai National Forest

Montana Department of Environmental Quality

Figures For
Environmental Impact Statement For The
Montanore Project

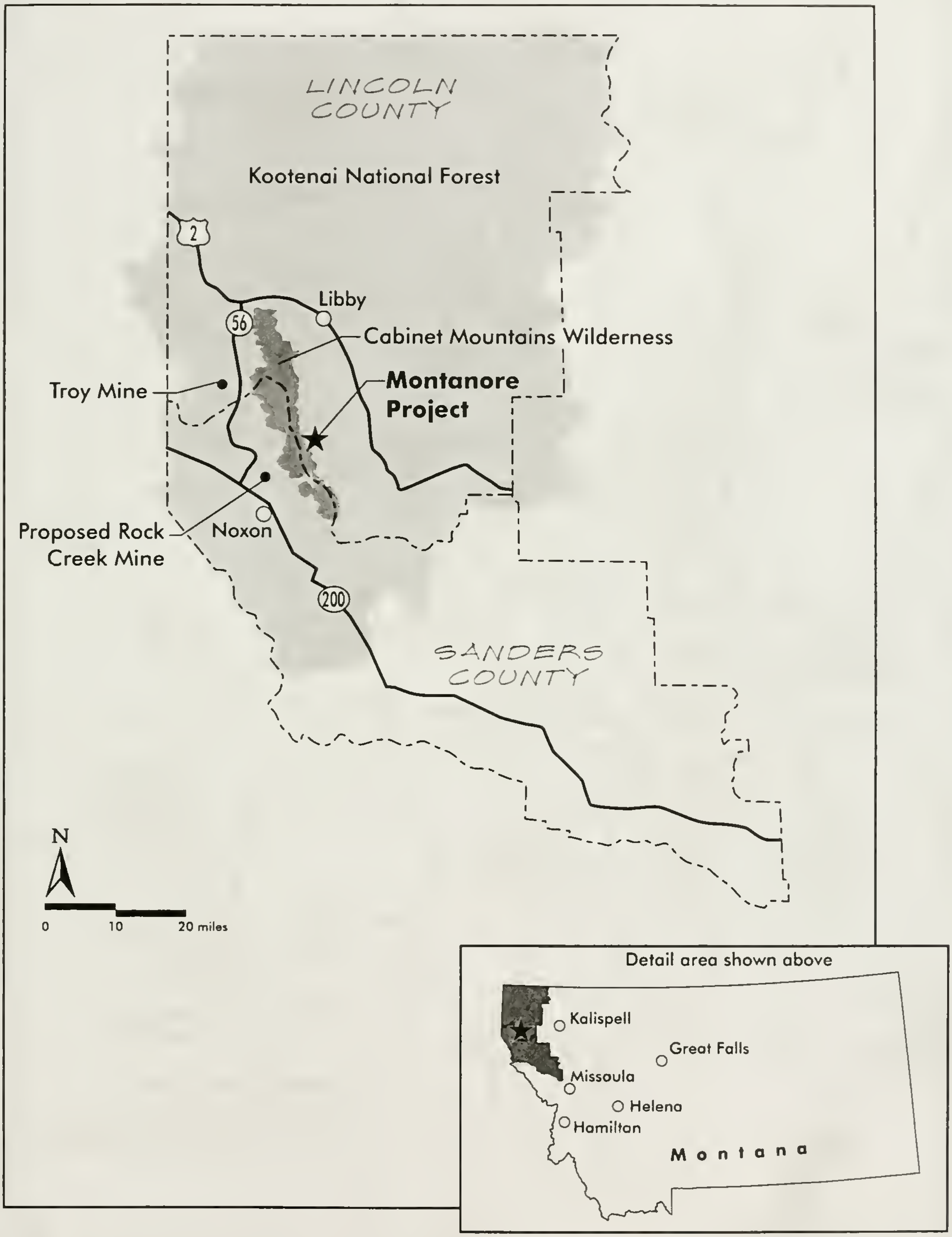


Figure 1. Location Map, Montanore Project, Kootenai National Forest.

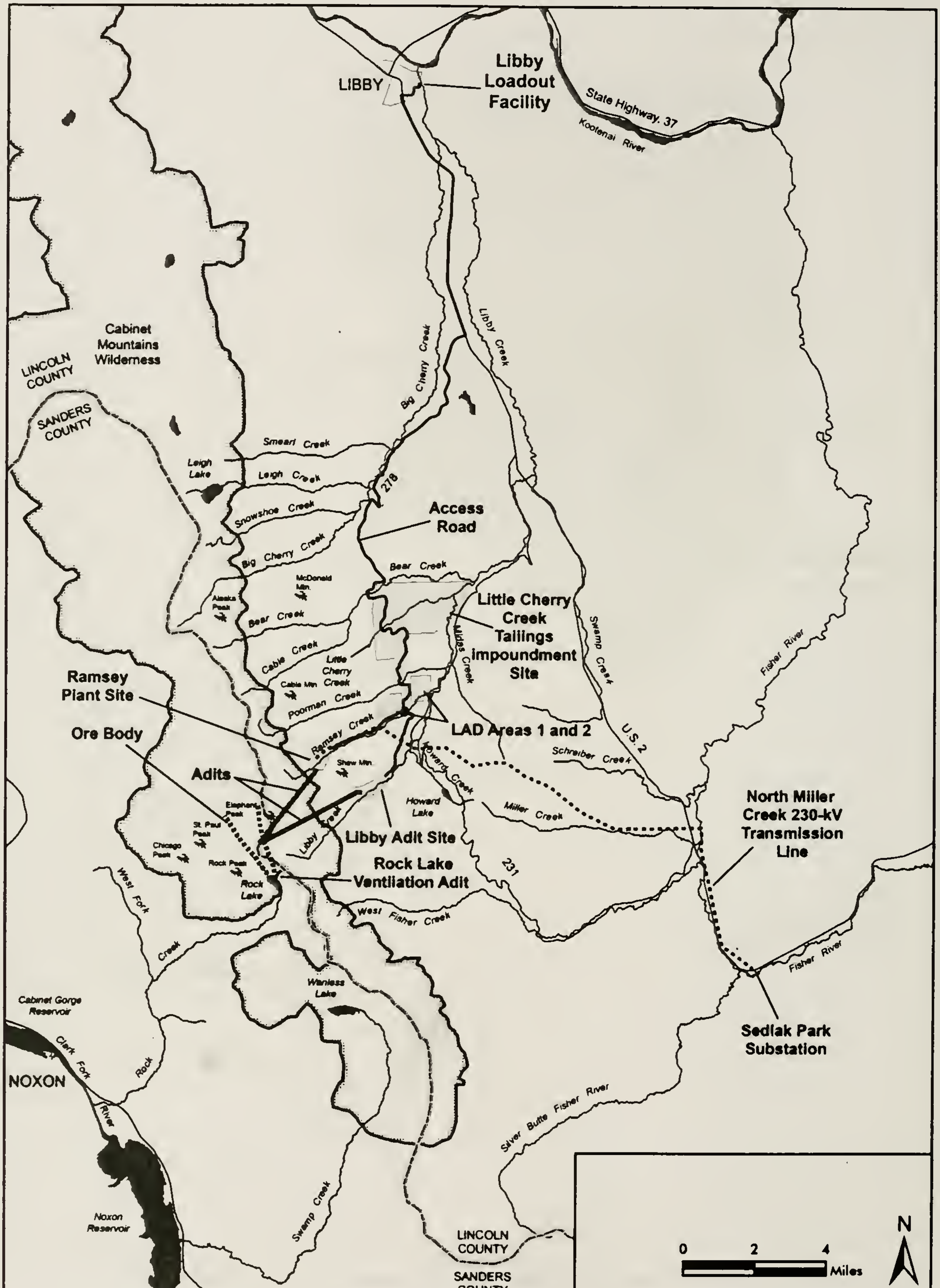


Figure 2. Location of Montanore Project Facilities, Alternative 2

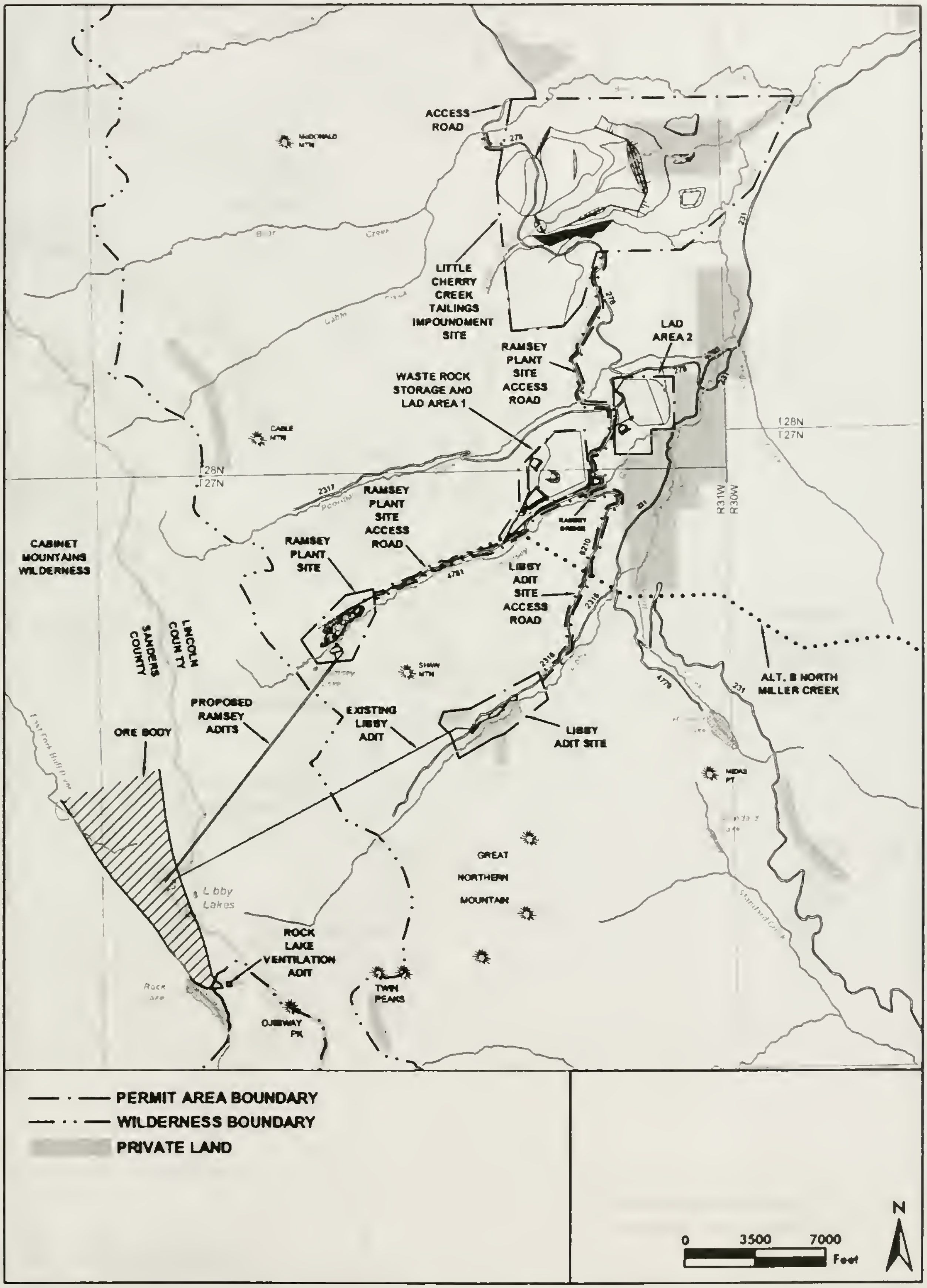


Figure 3. Mine Facilities and Permit Areas, Alternative 2

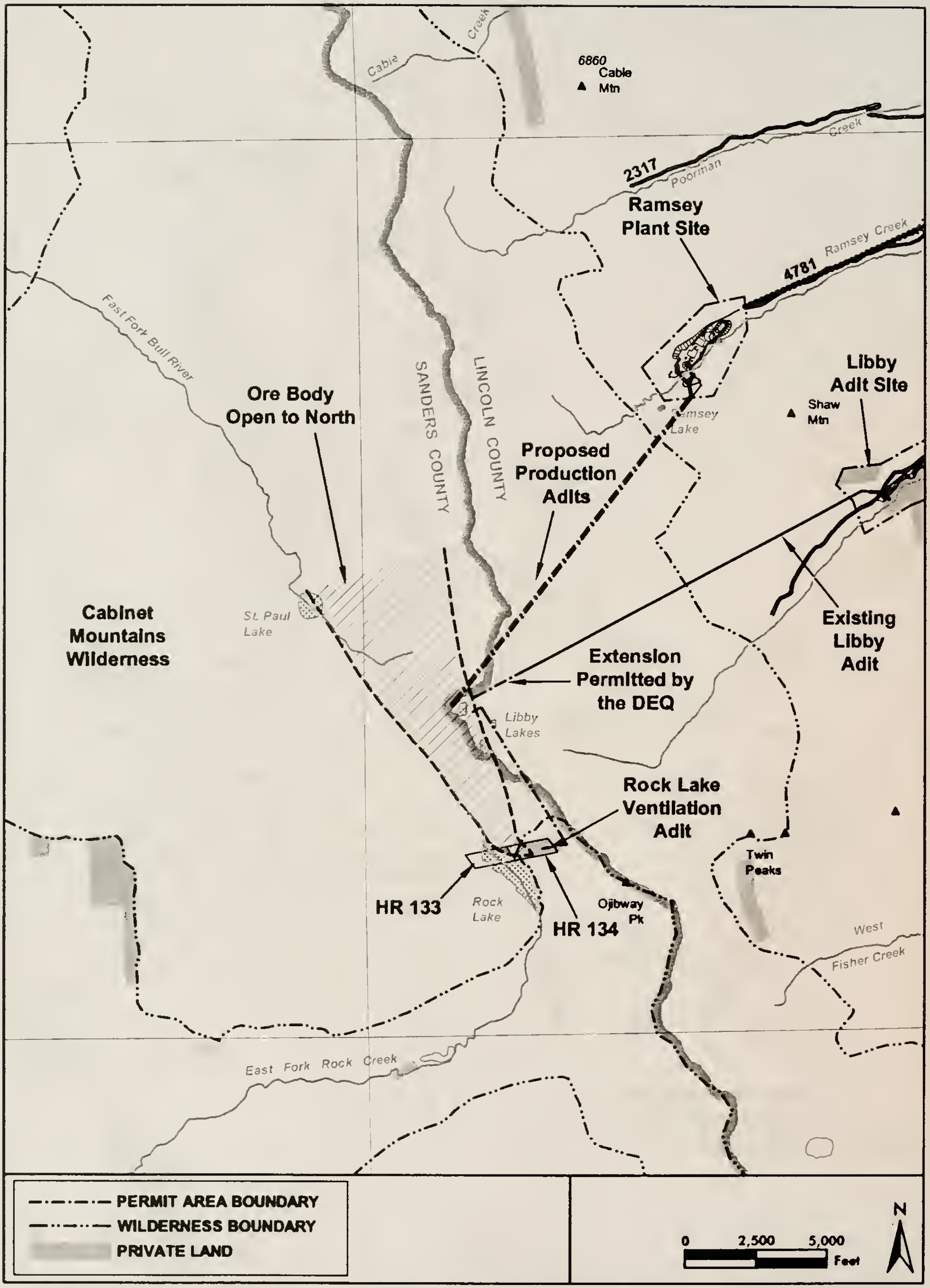


Figure 4. Existing Libby Adit and Proposed Ramsey Adits, Alternative 2

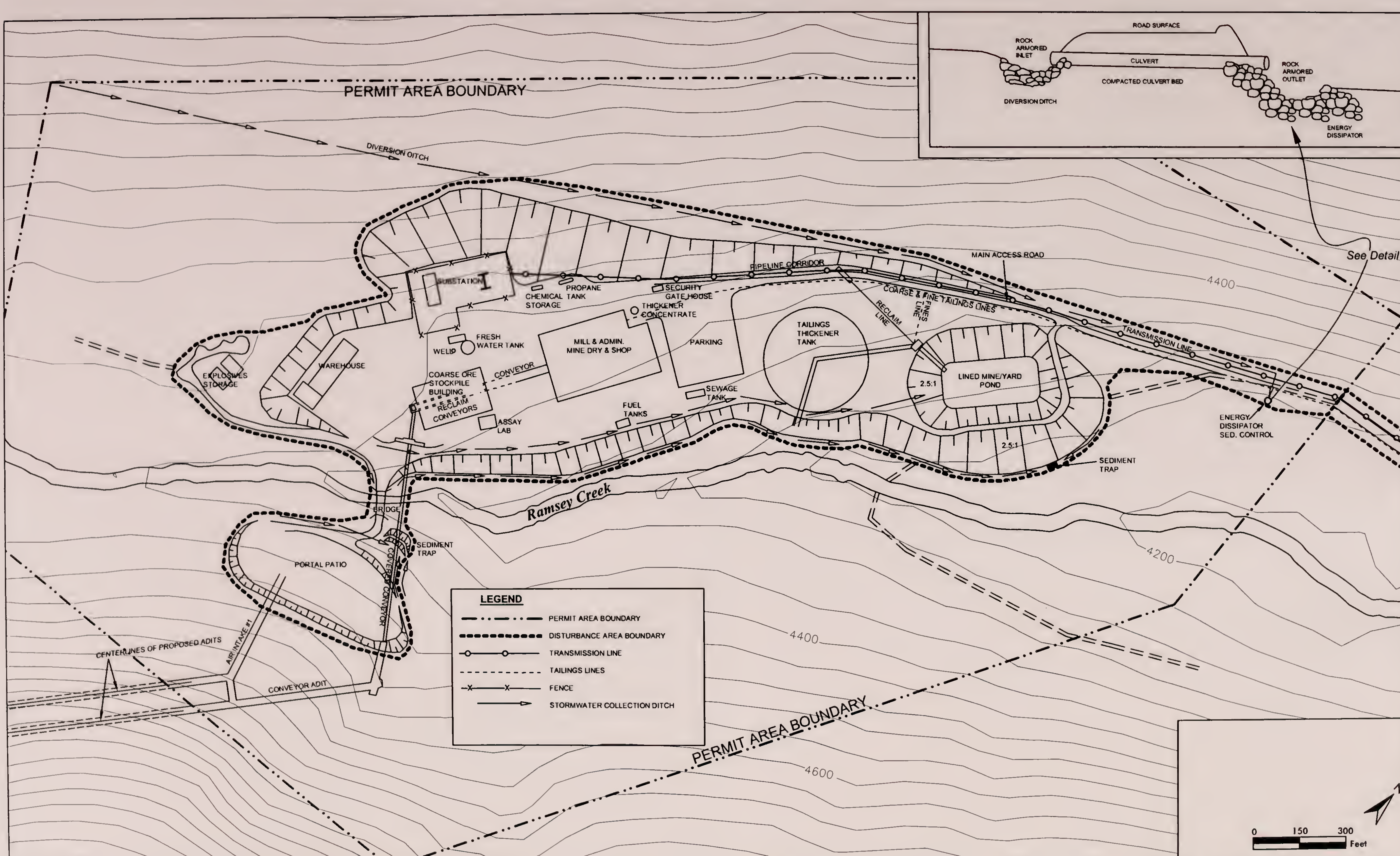
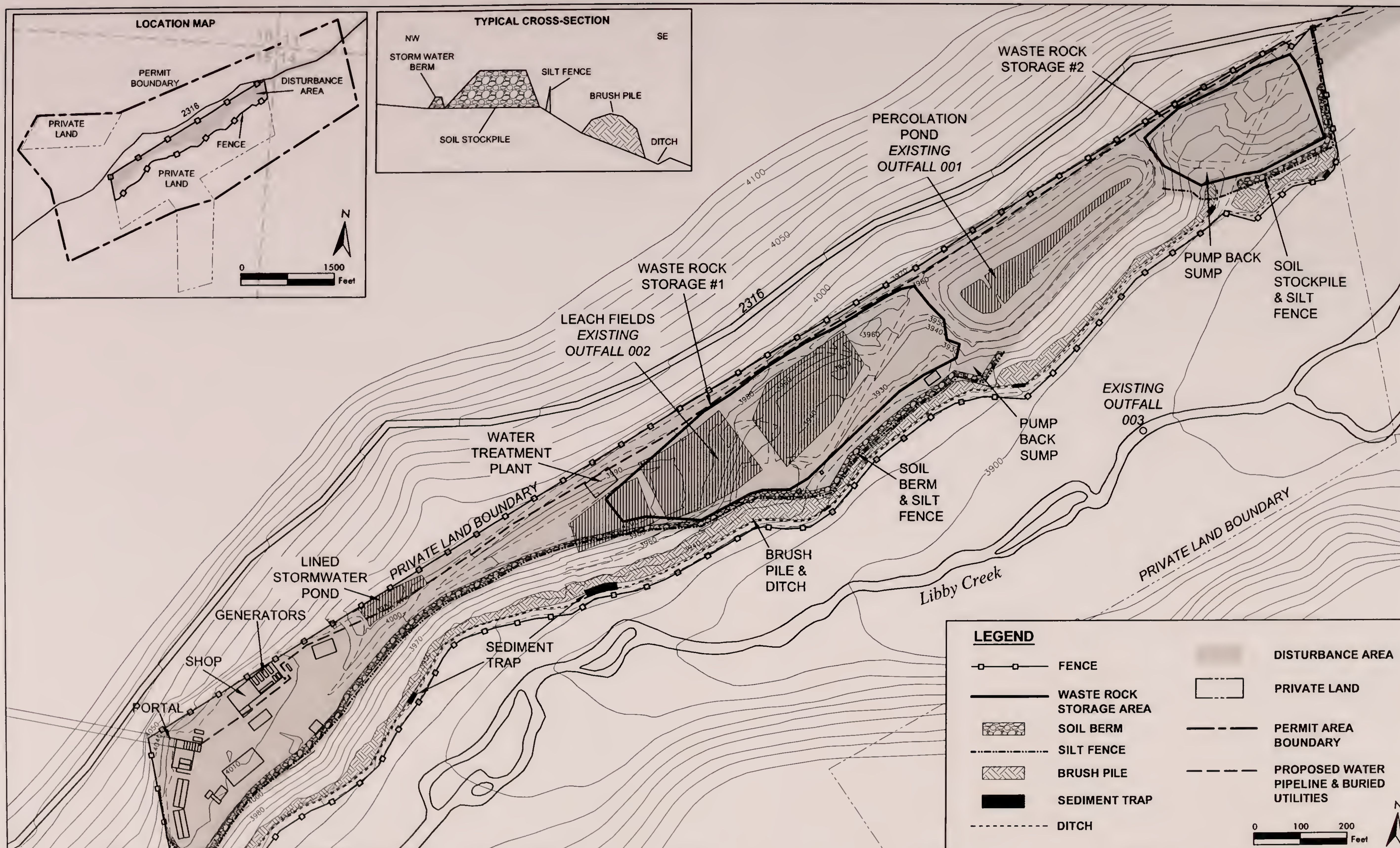


Figure 5. Ramsey Plant Site, Alternative 2



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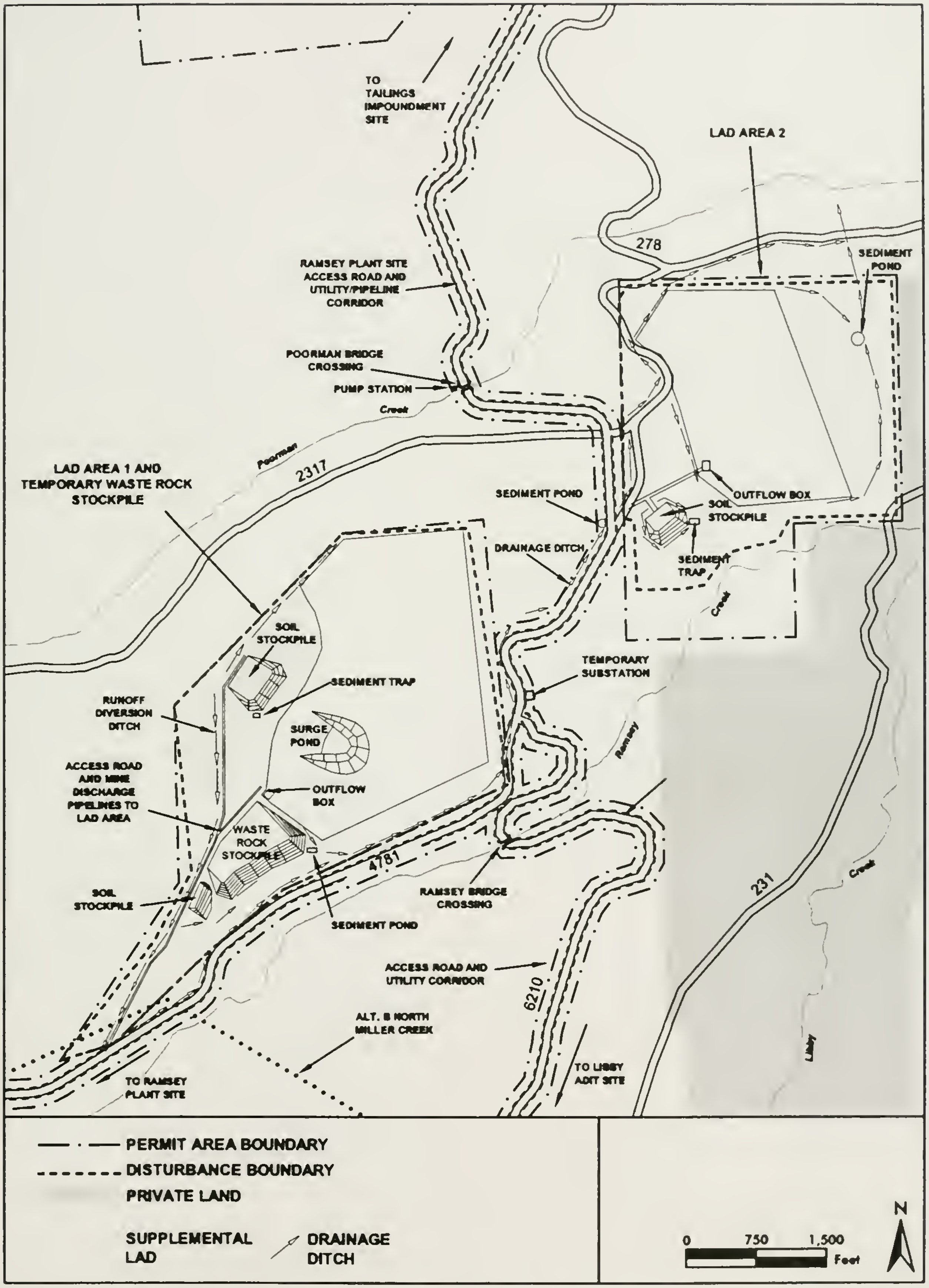

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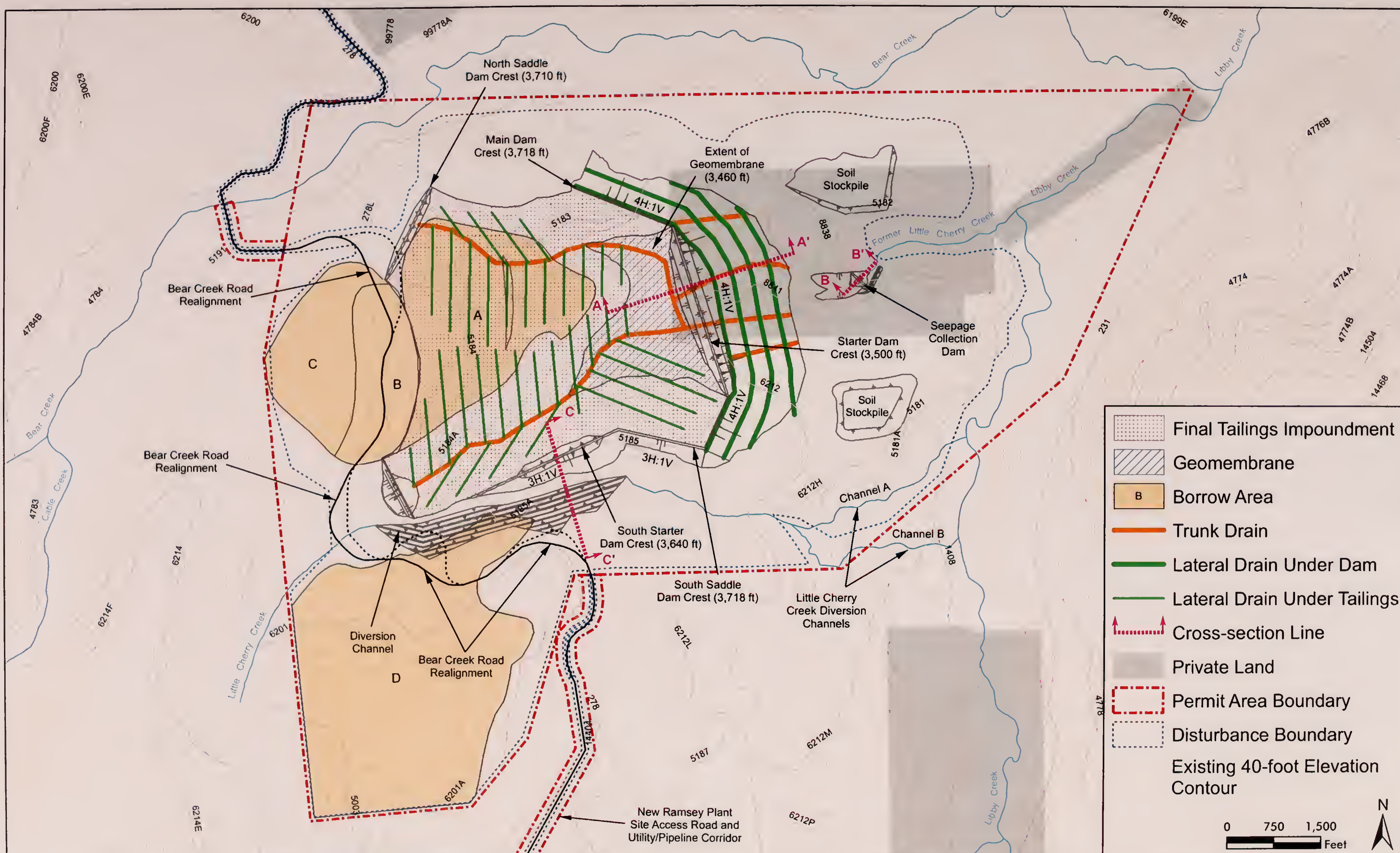


Figure 8. Little Cherry Creek Tailings Impoundment Site, Alternative 2

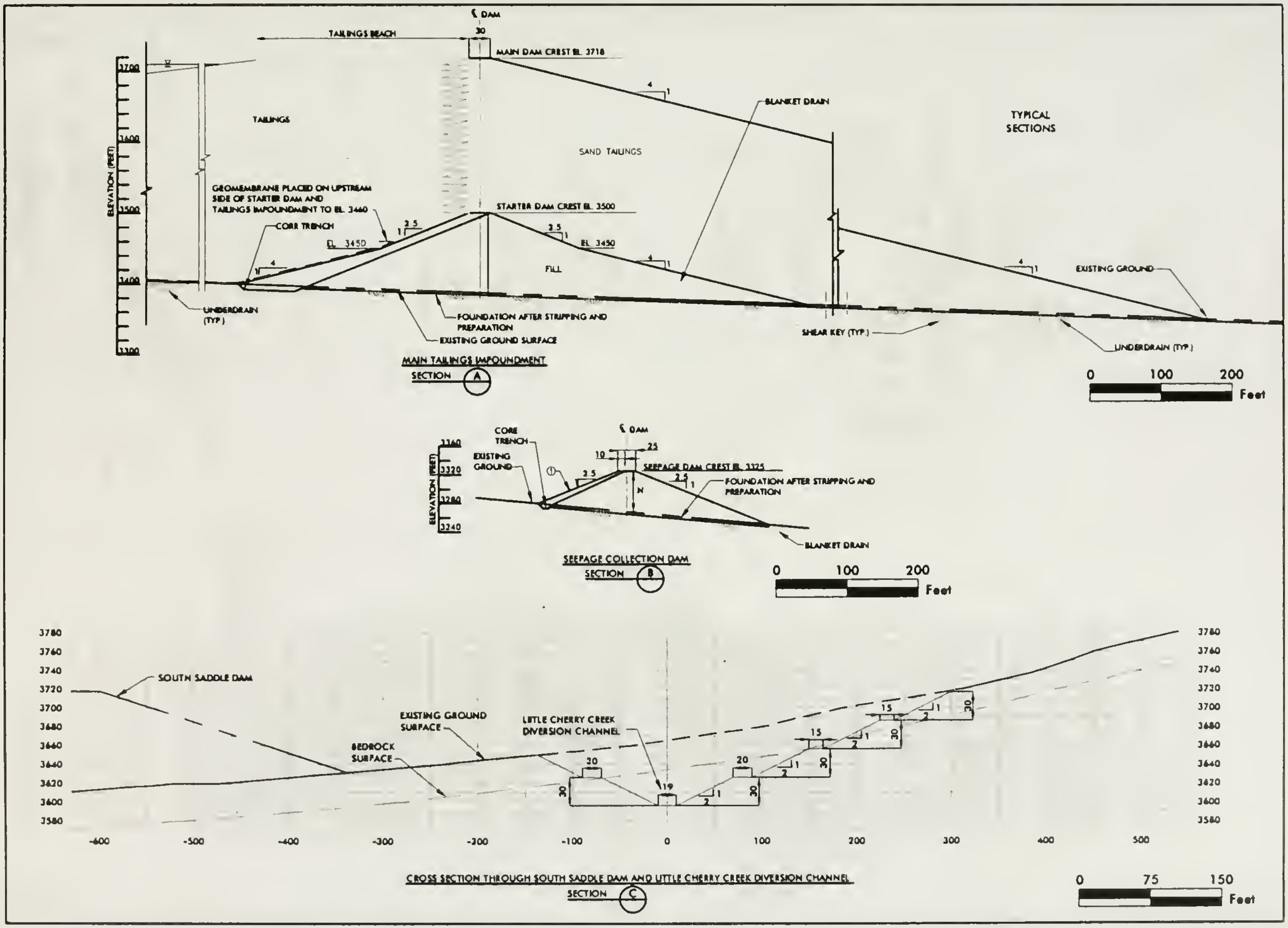
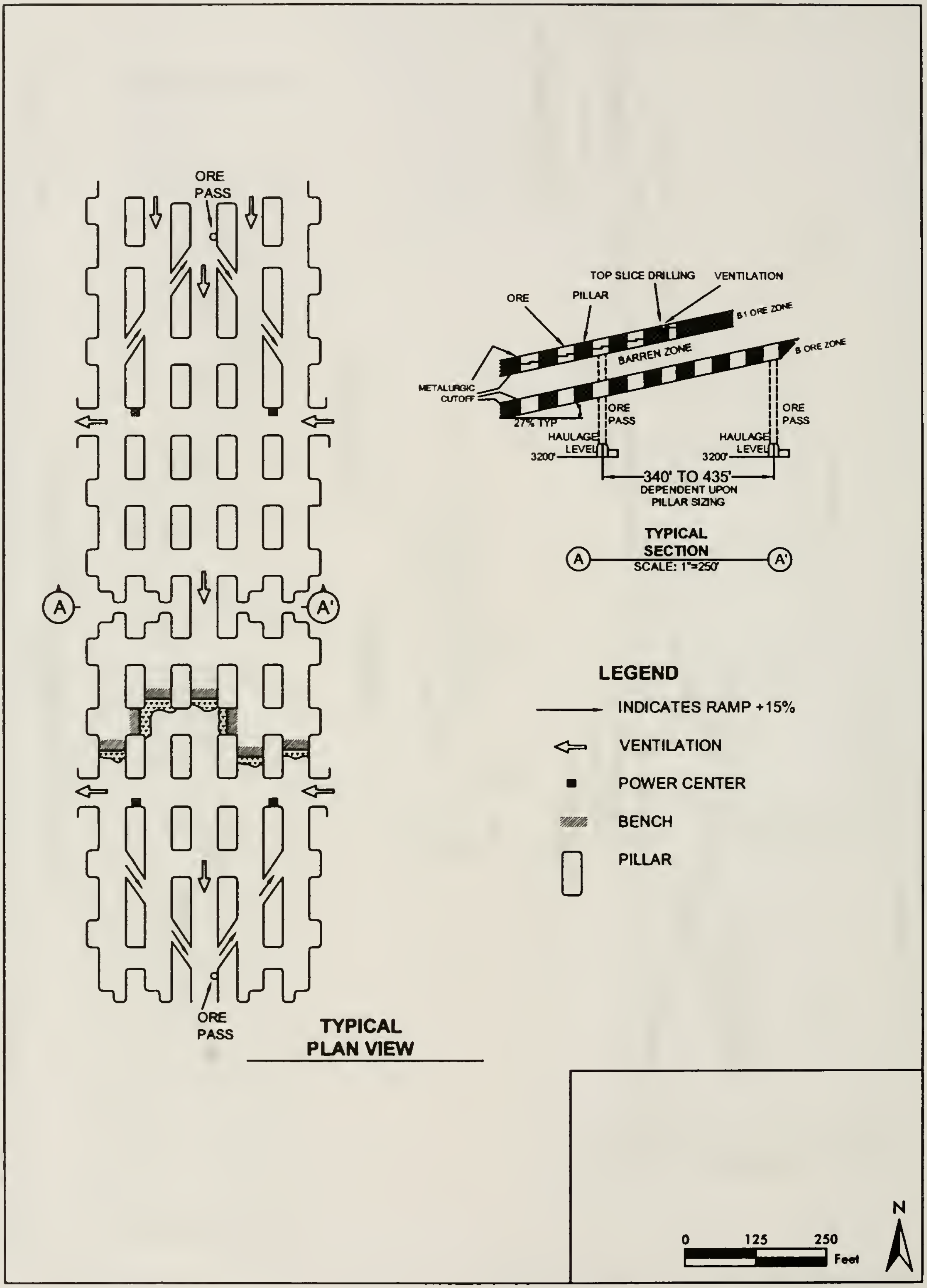


Figure 9. Little Cherry Creek Tailings Impoundment Cross Sections



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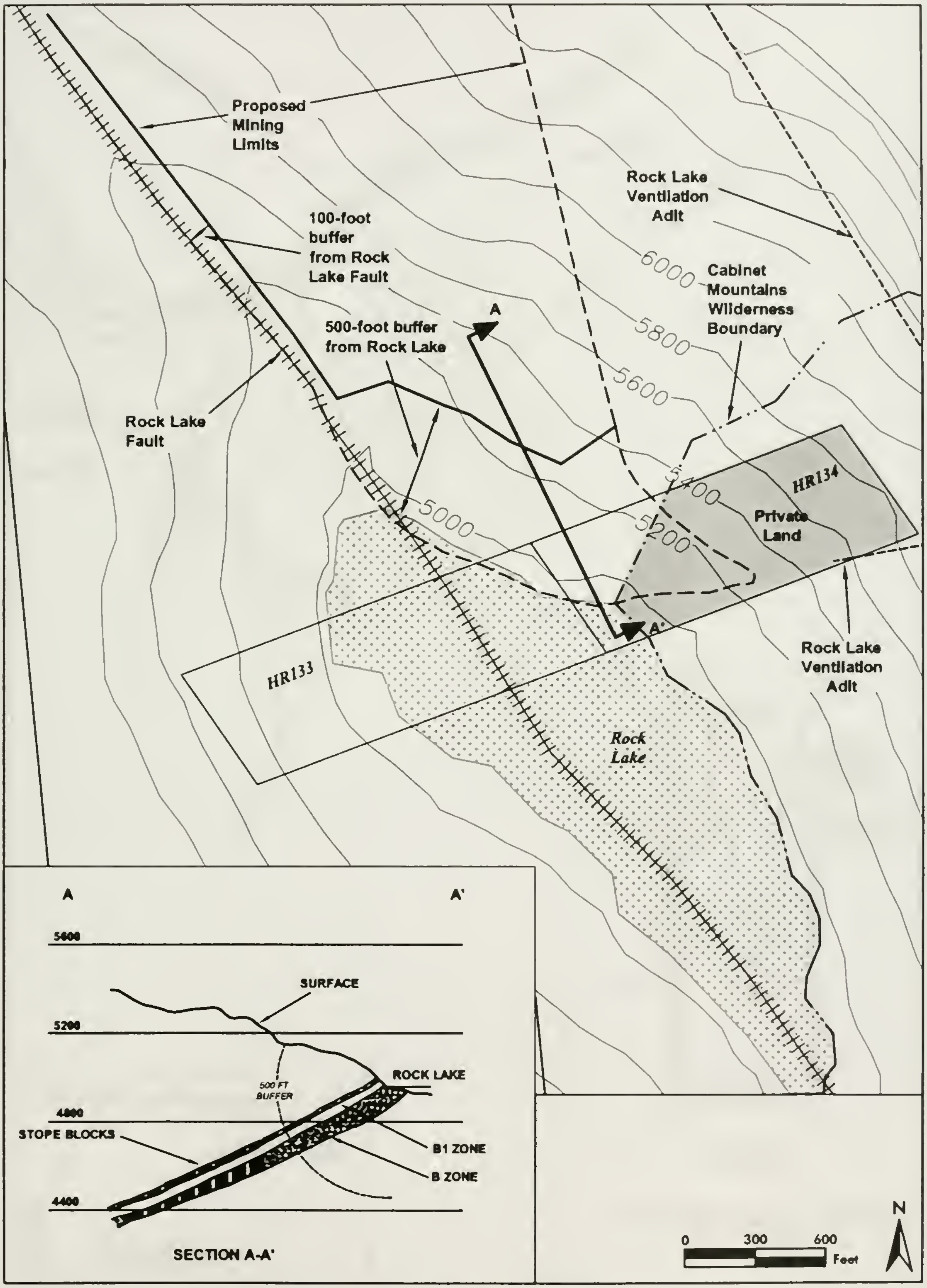

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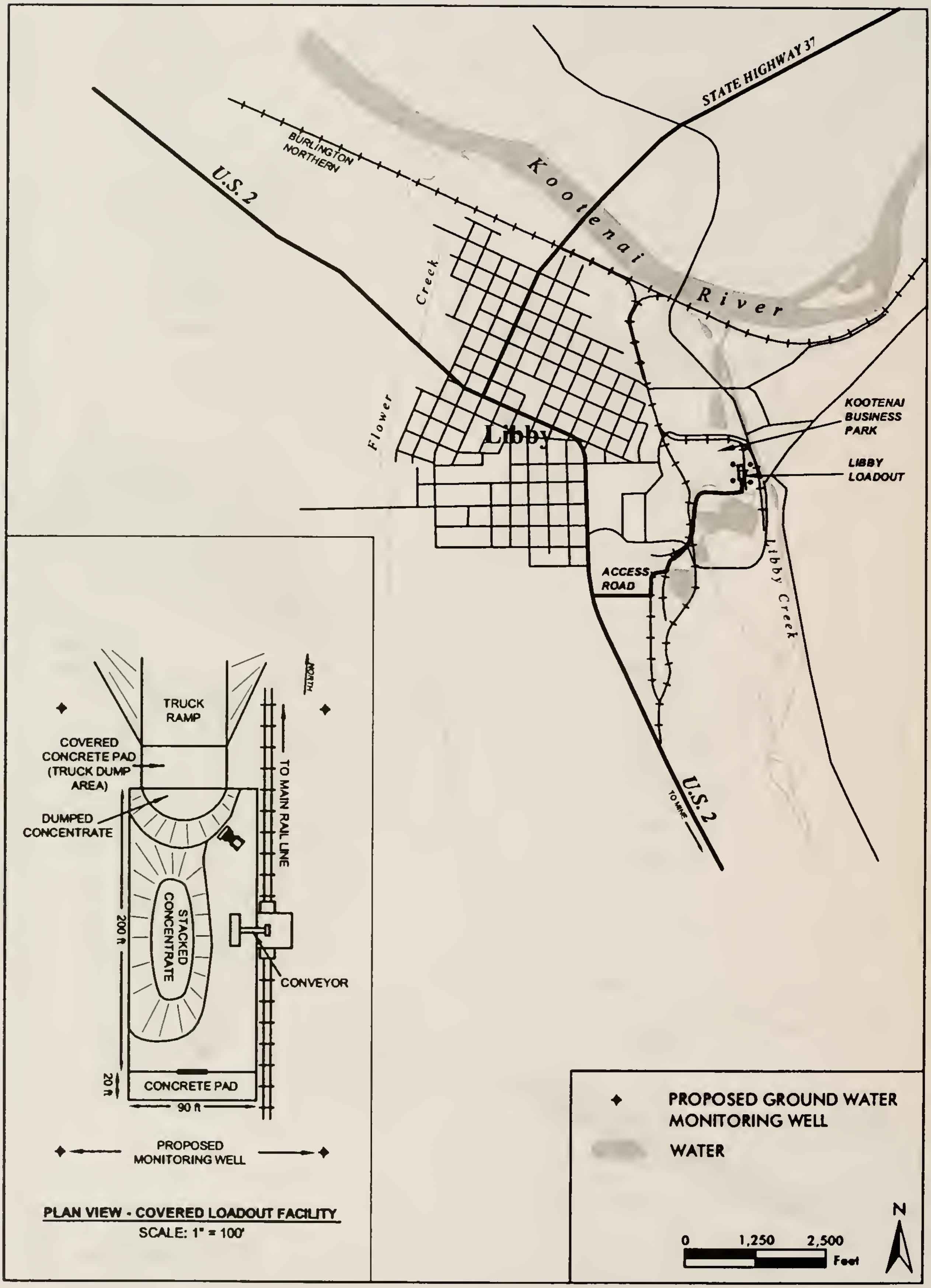
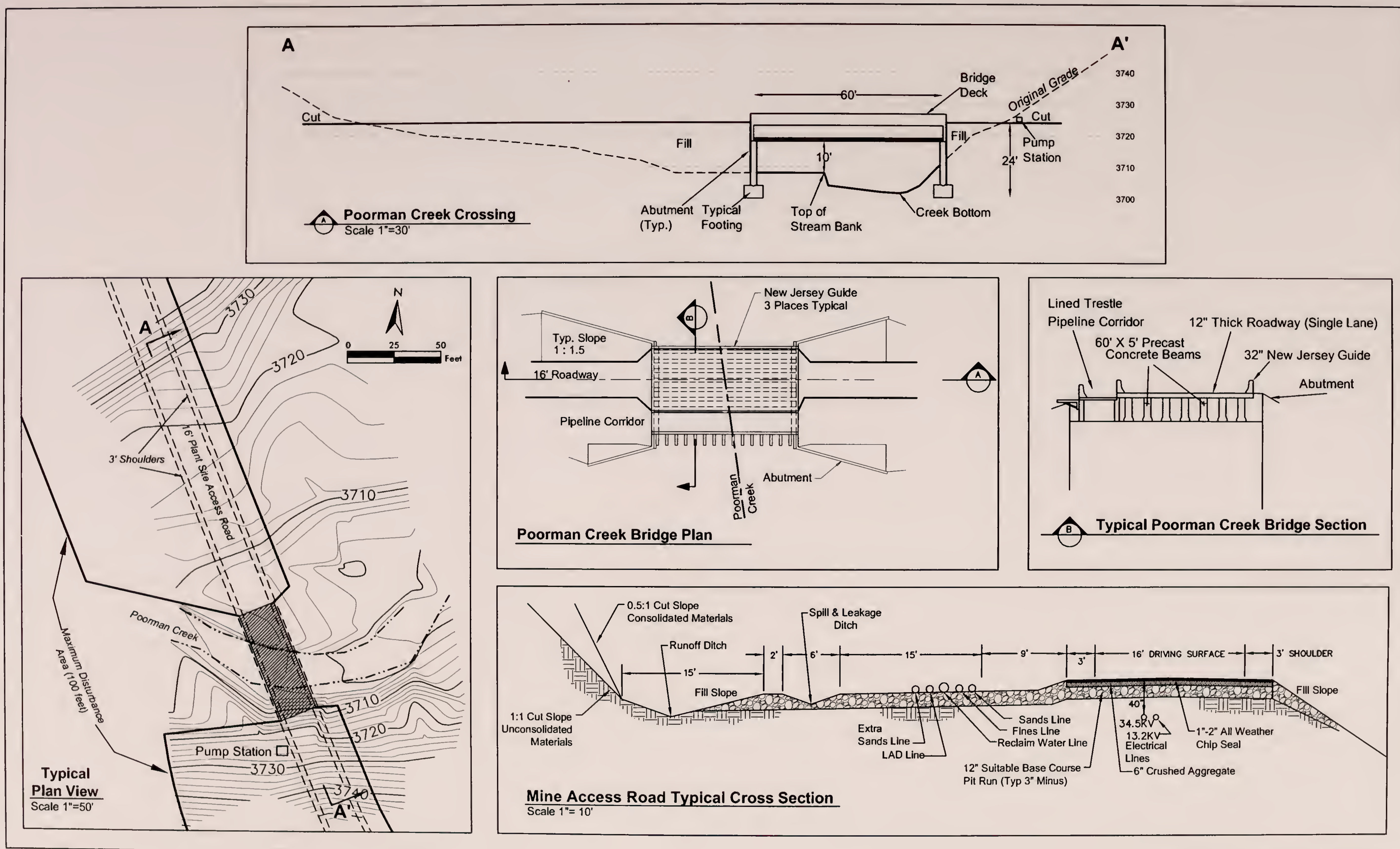


Figure 12. Libby Loadout



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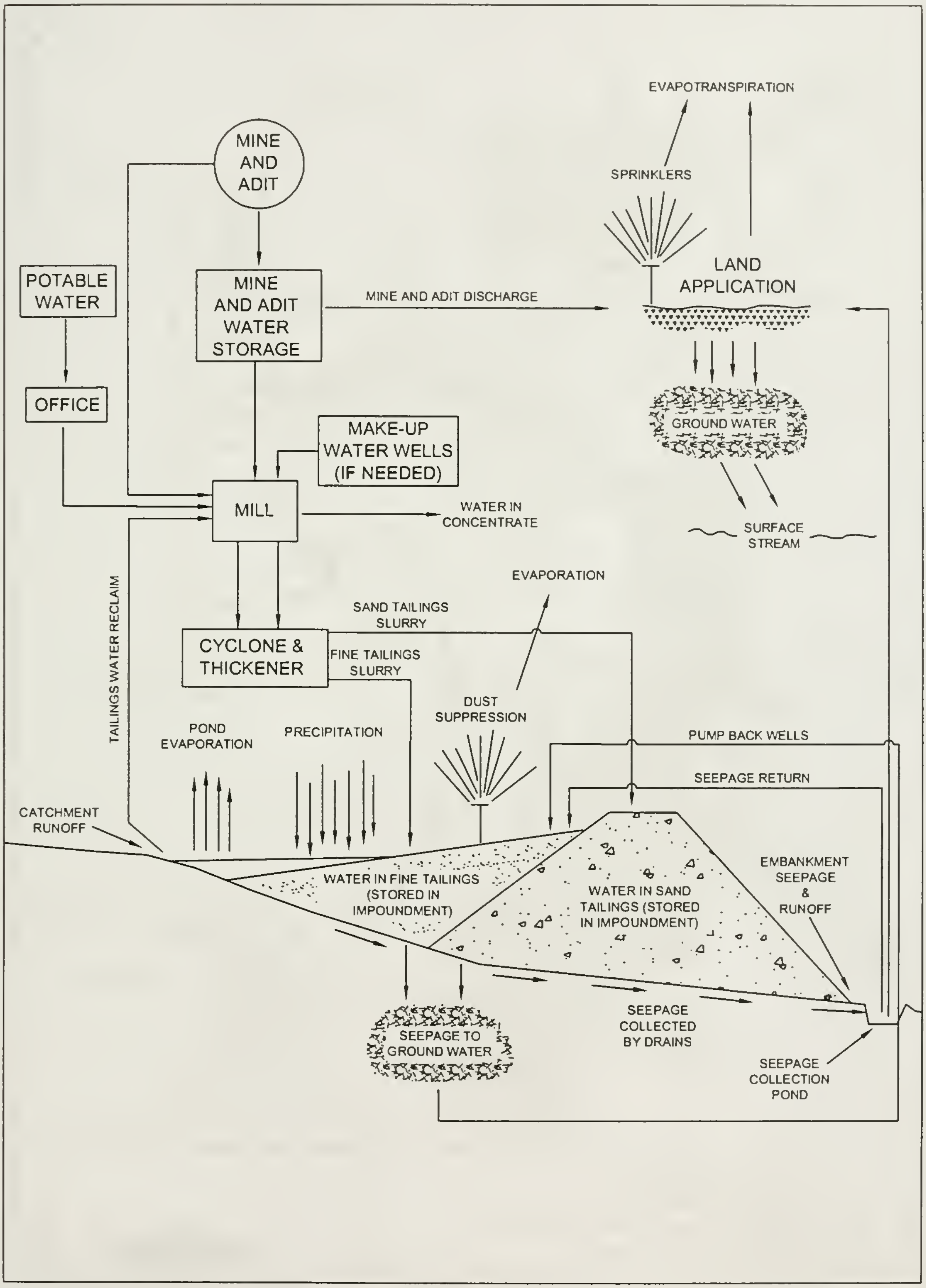

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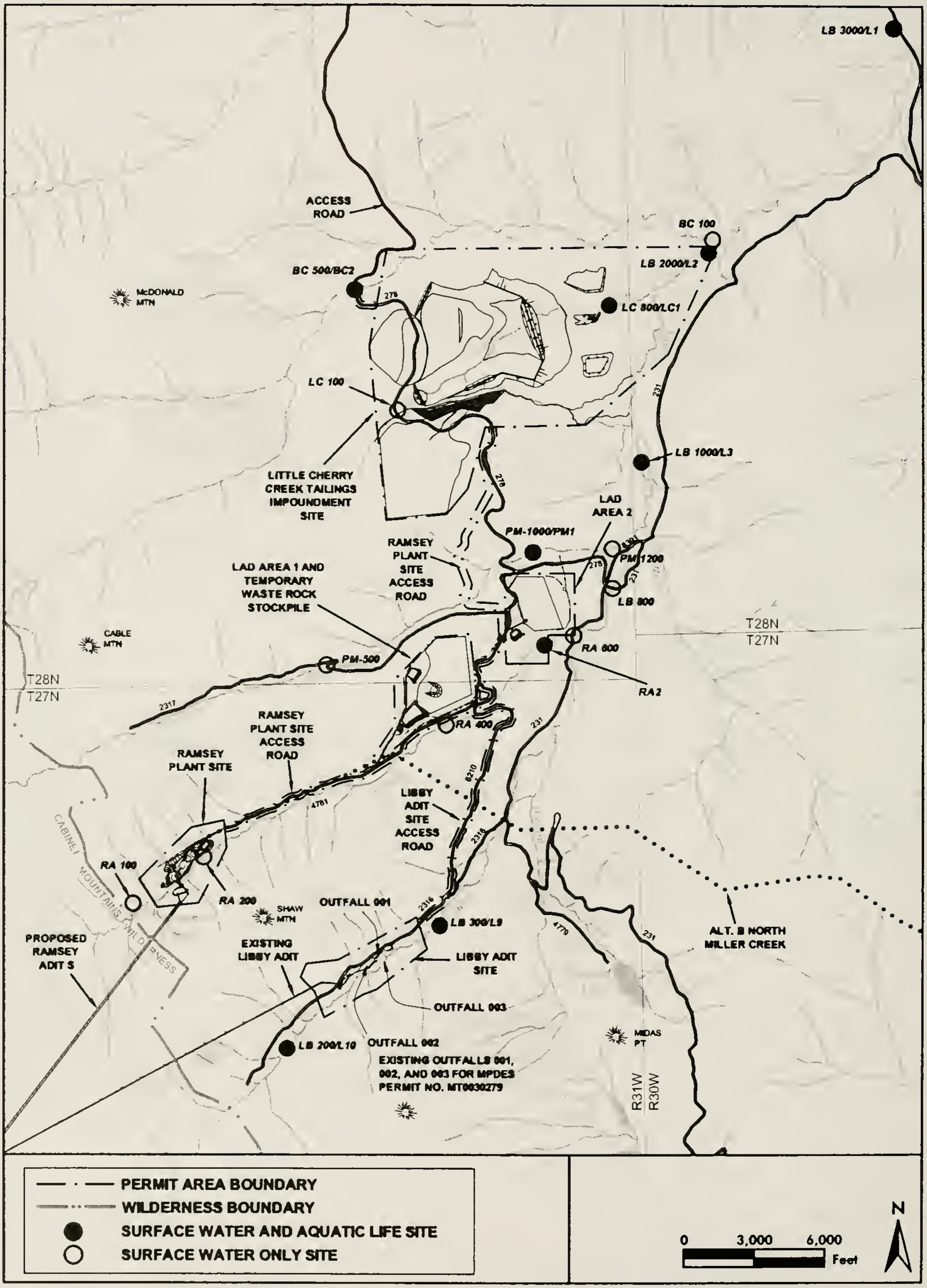

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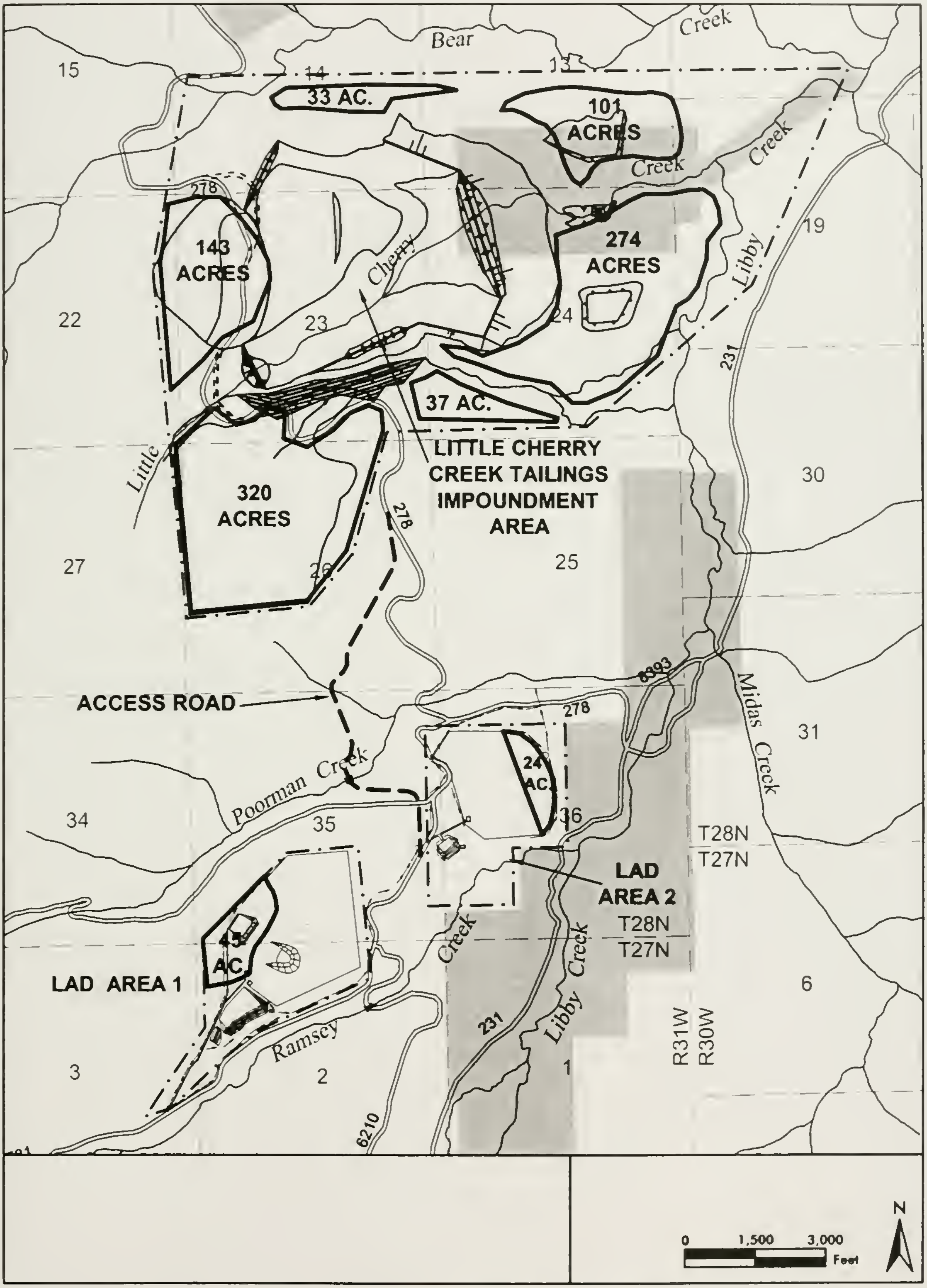

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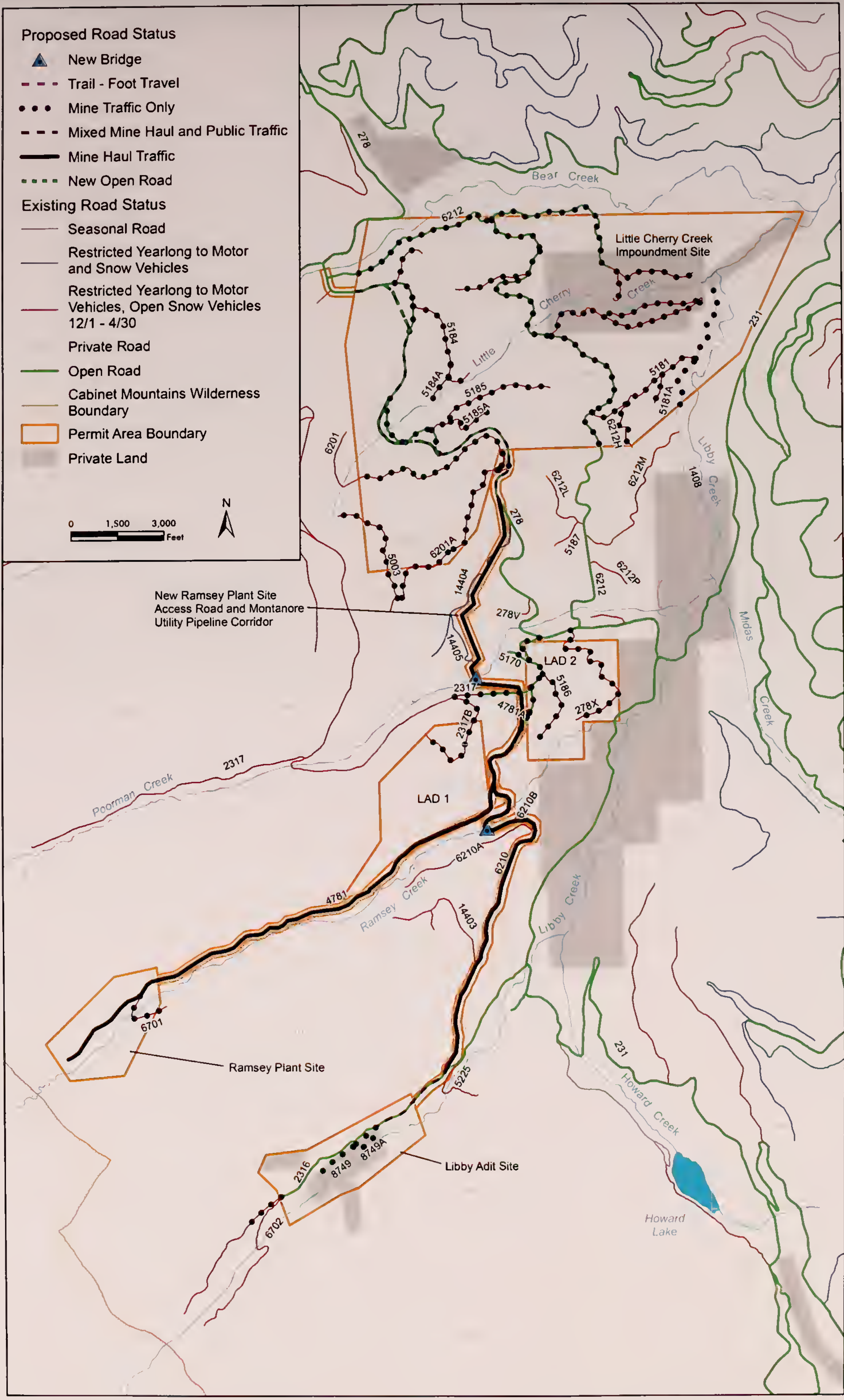


Figure 17. Roads Proposed for Use in Alternative 2

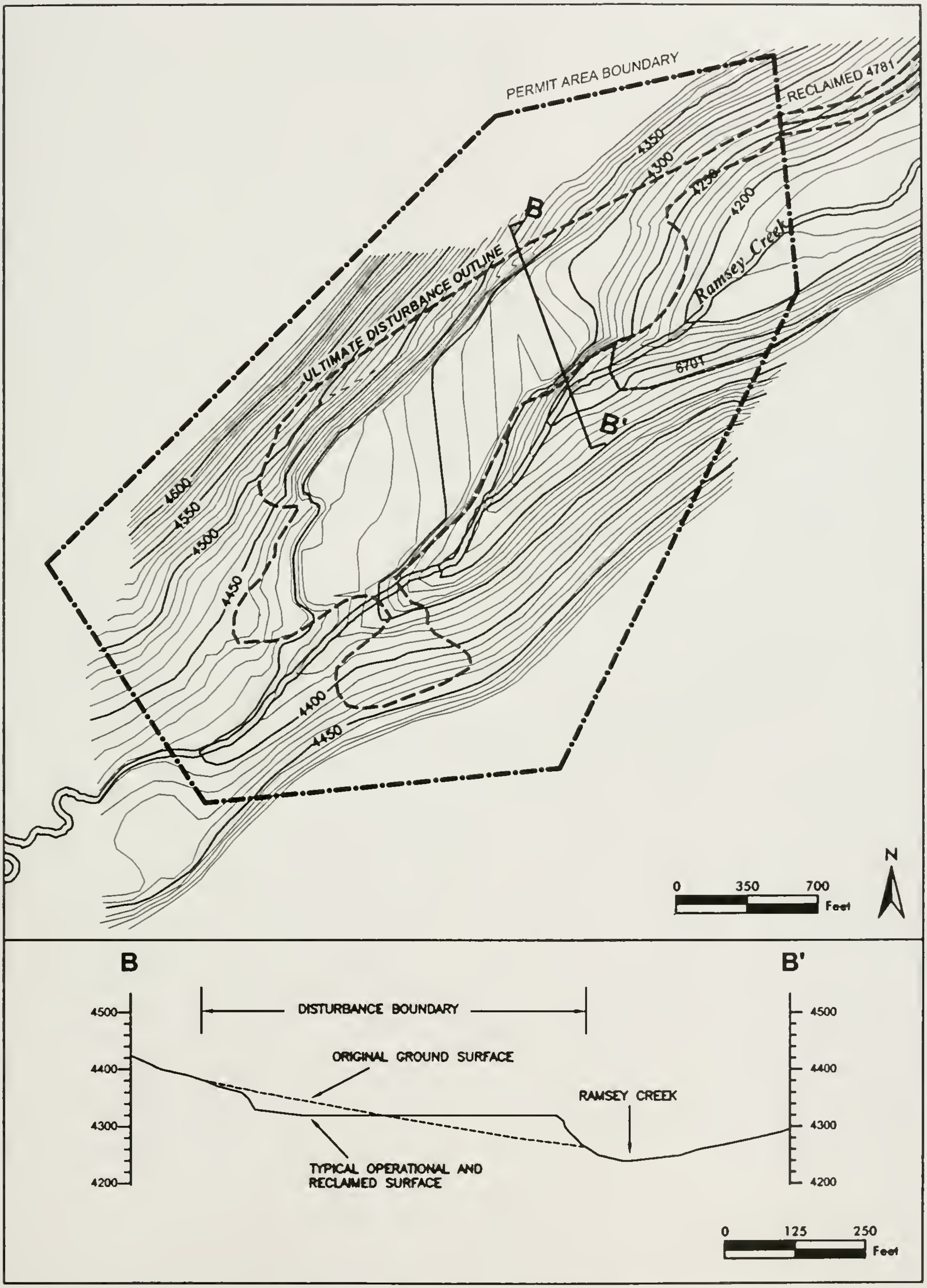
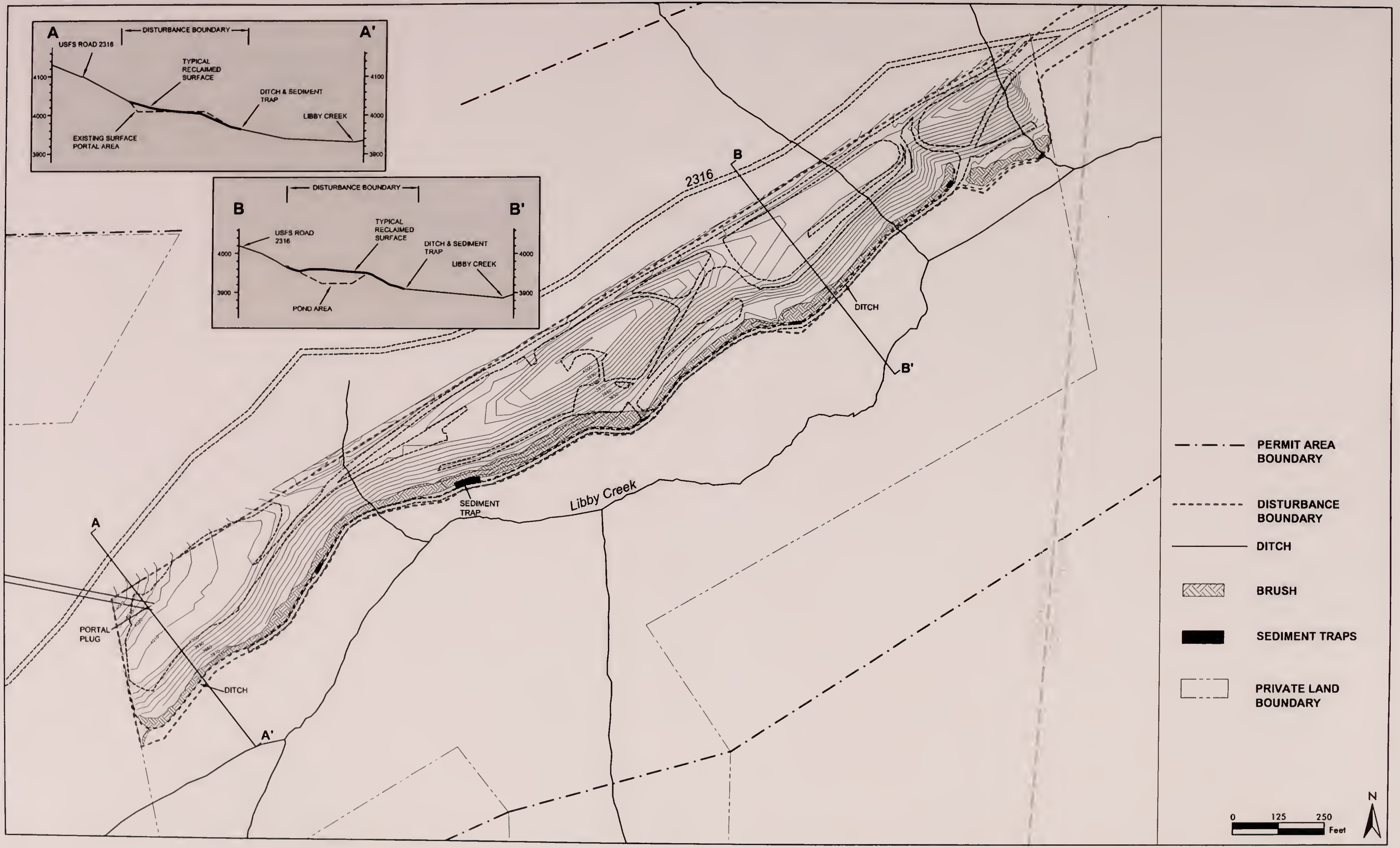


Figure 18. Post-mining Topography, Ramsey Plant Site, Alternative 2



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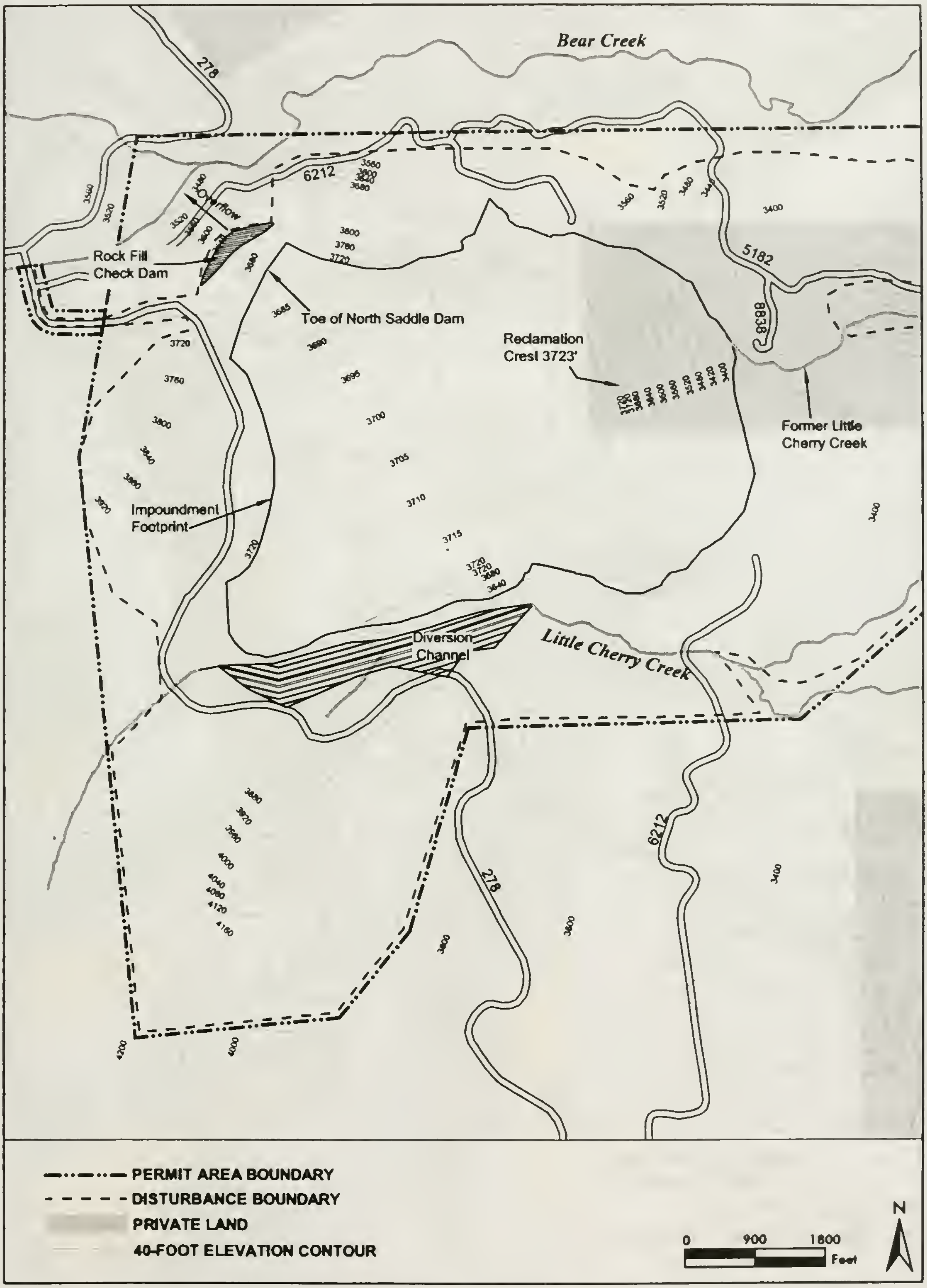

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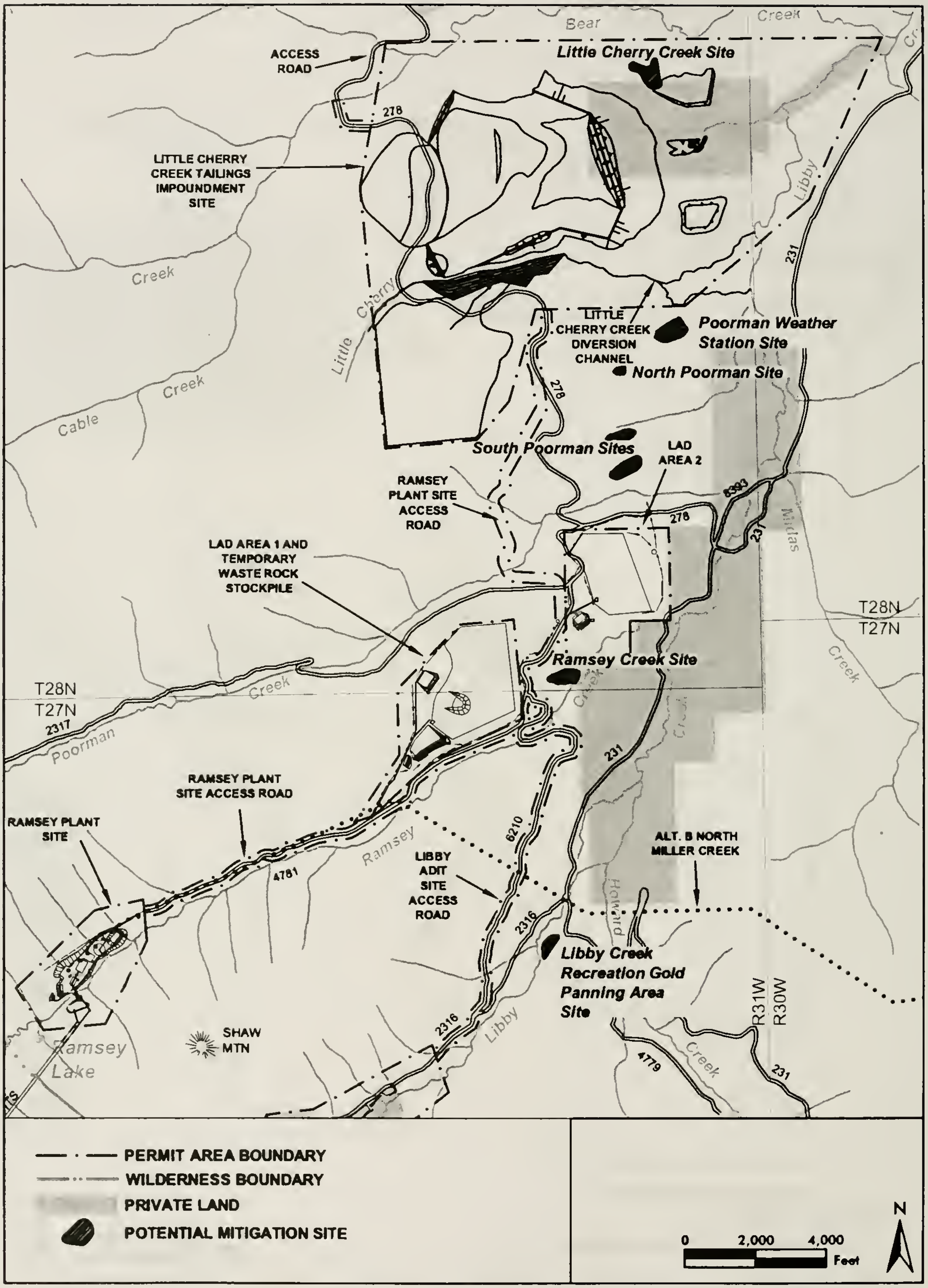

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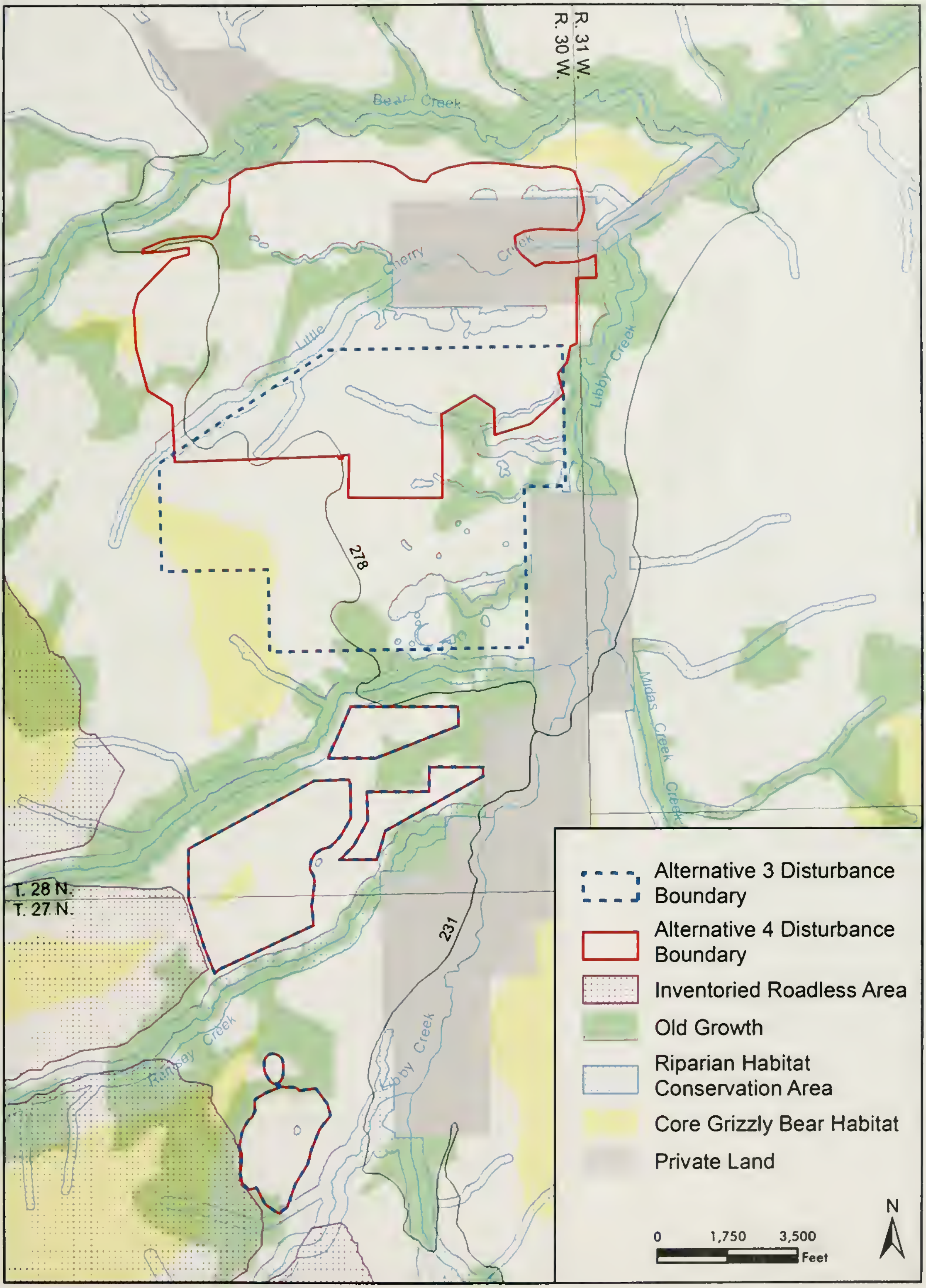

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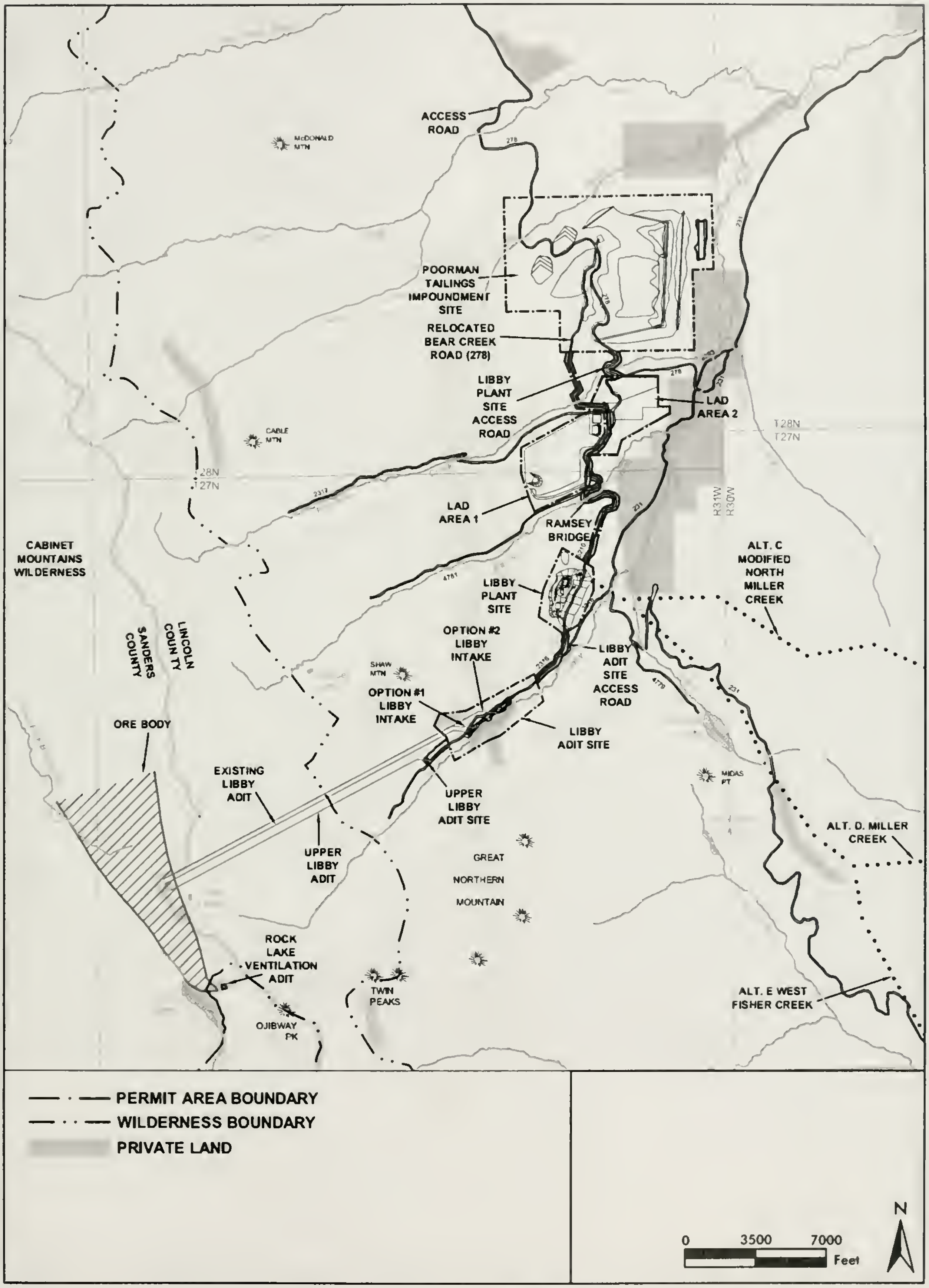

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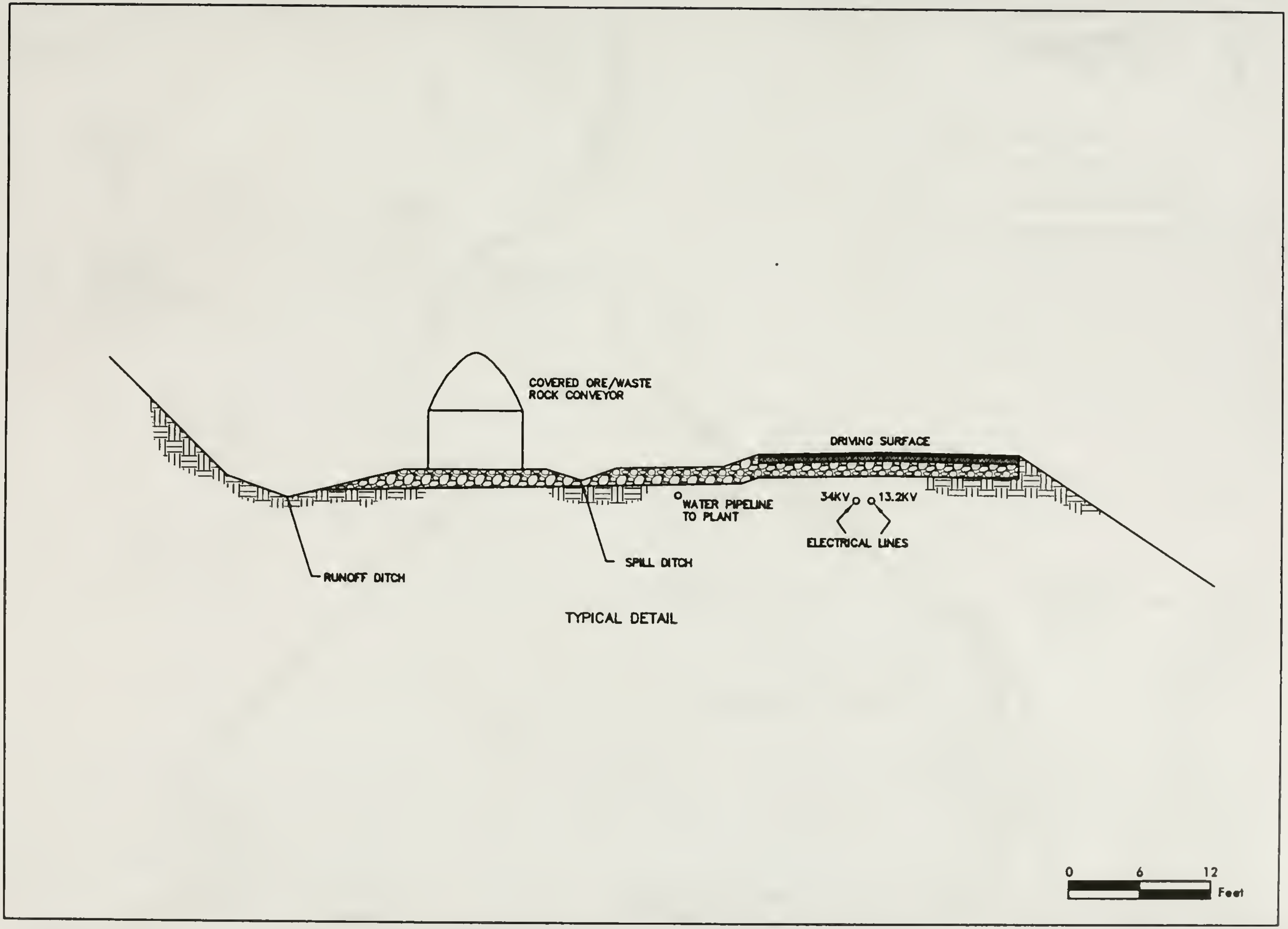

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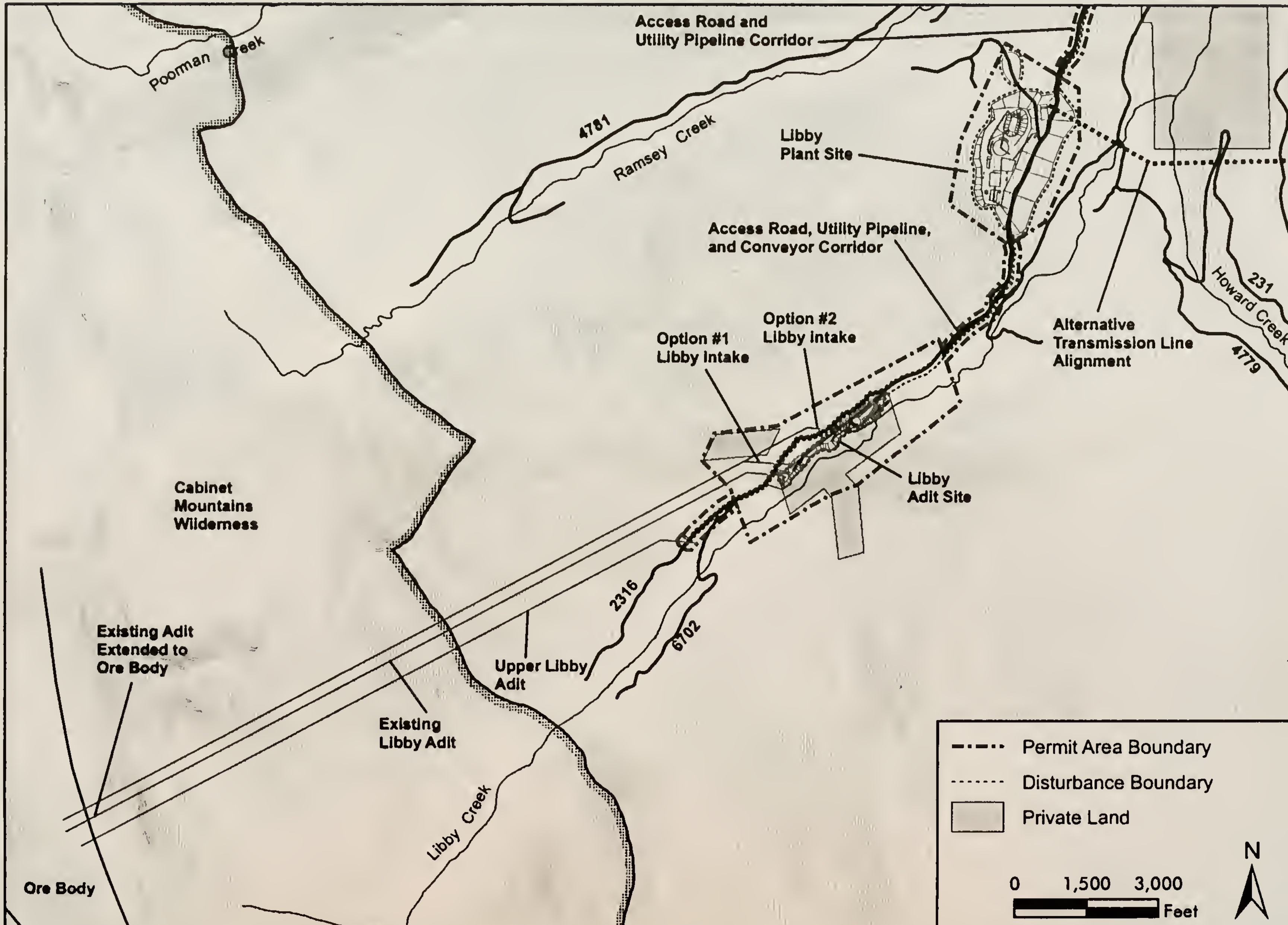

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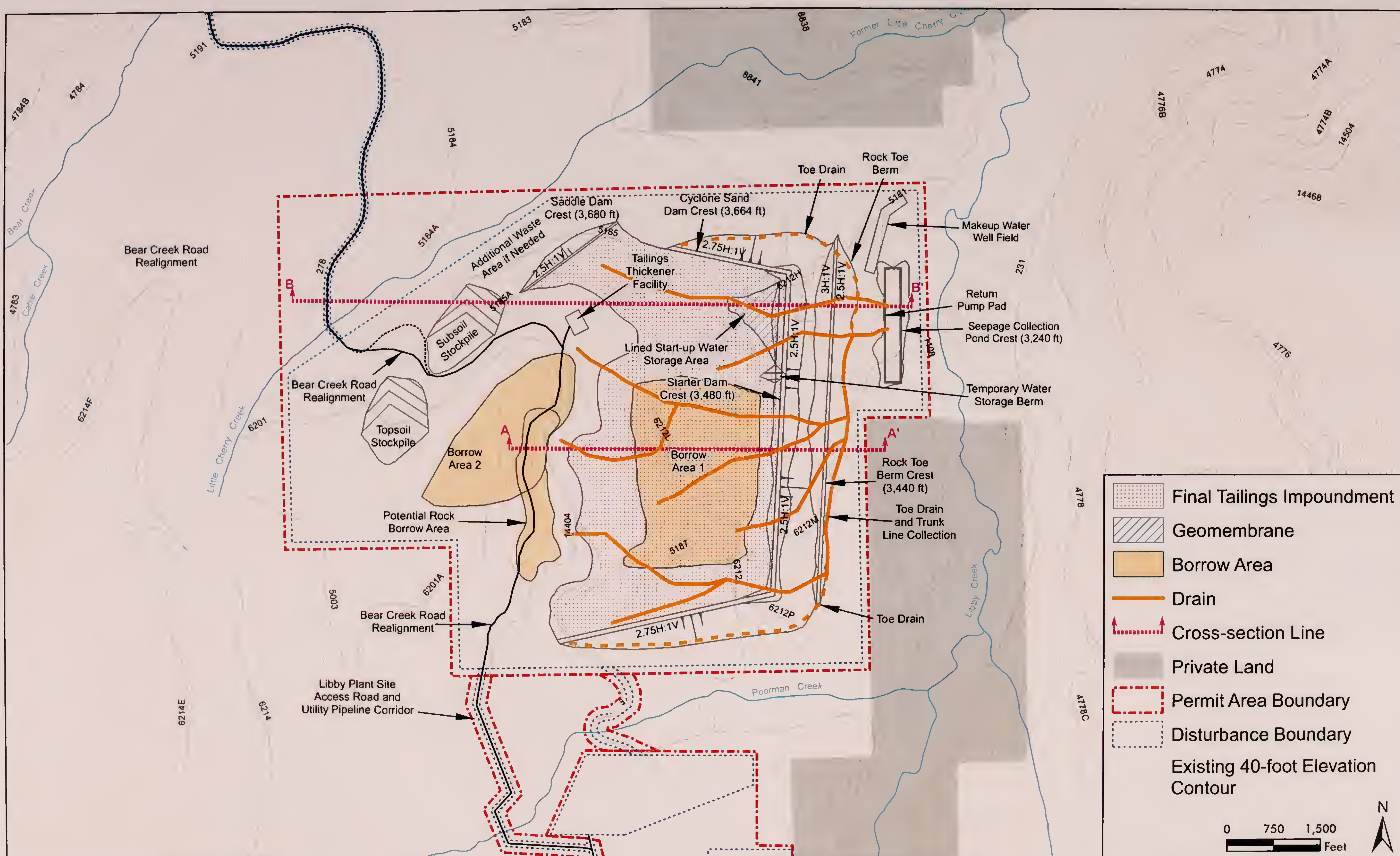

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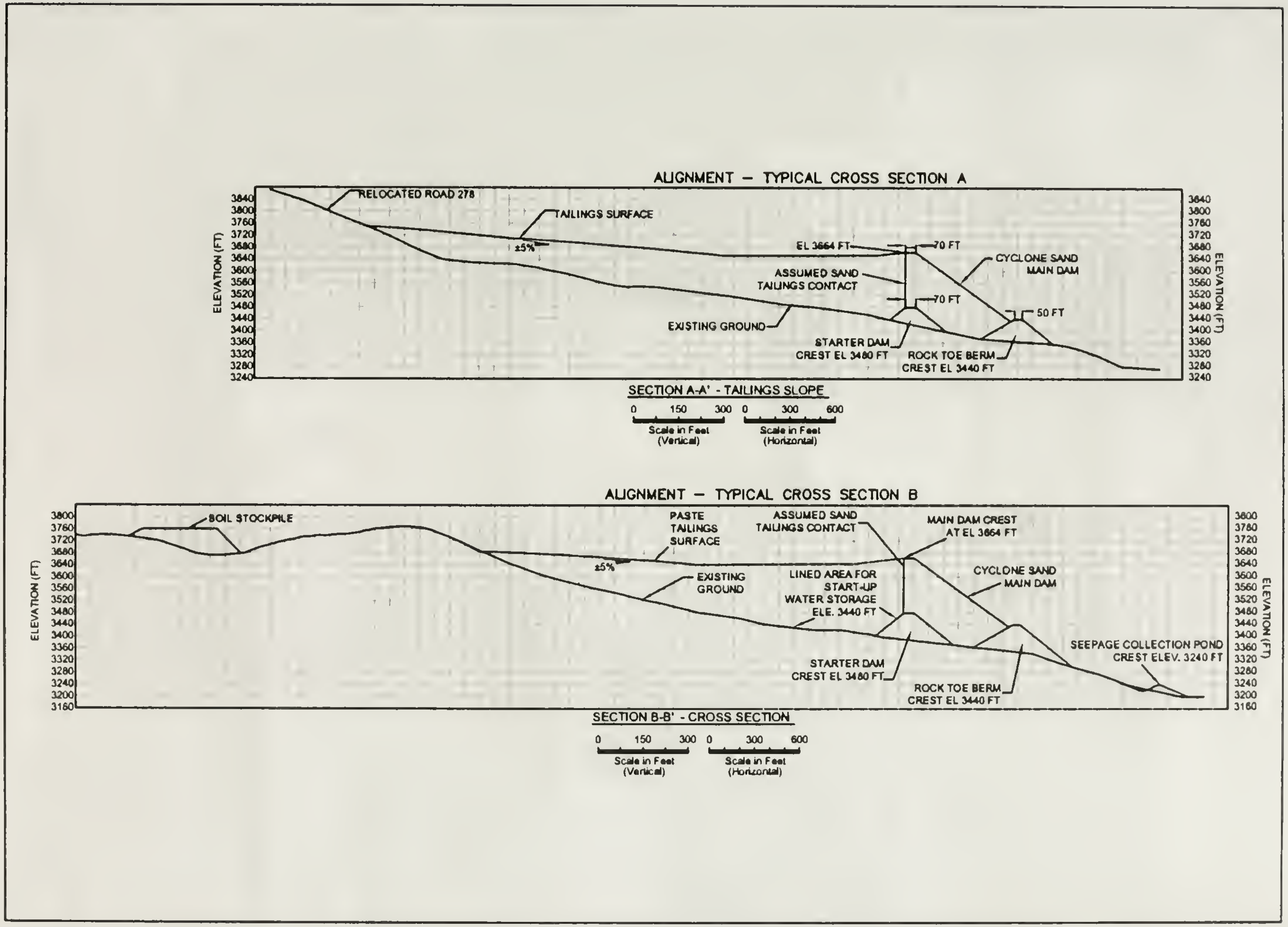
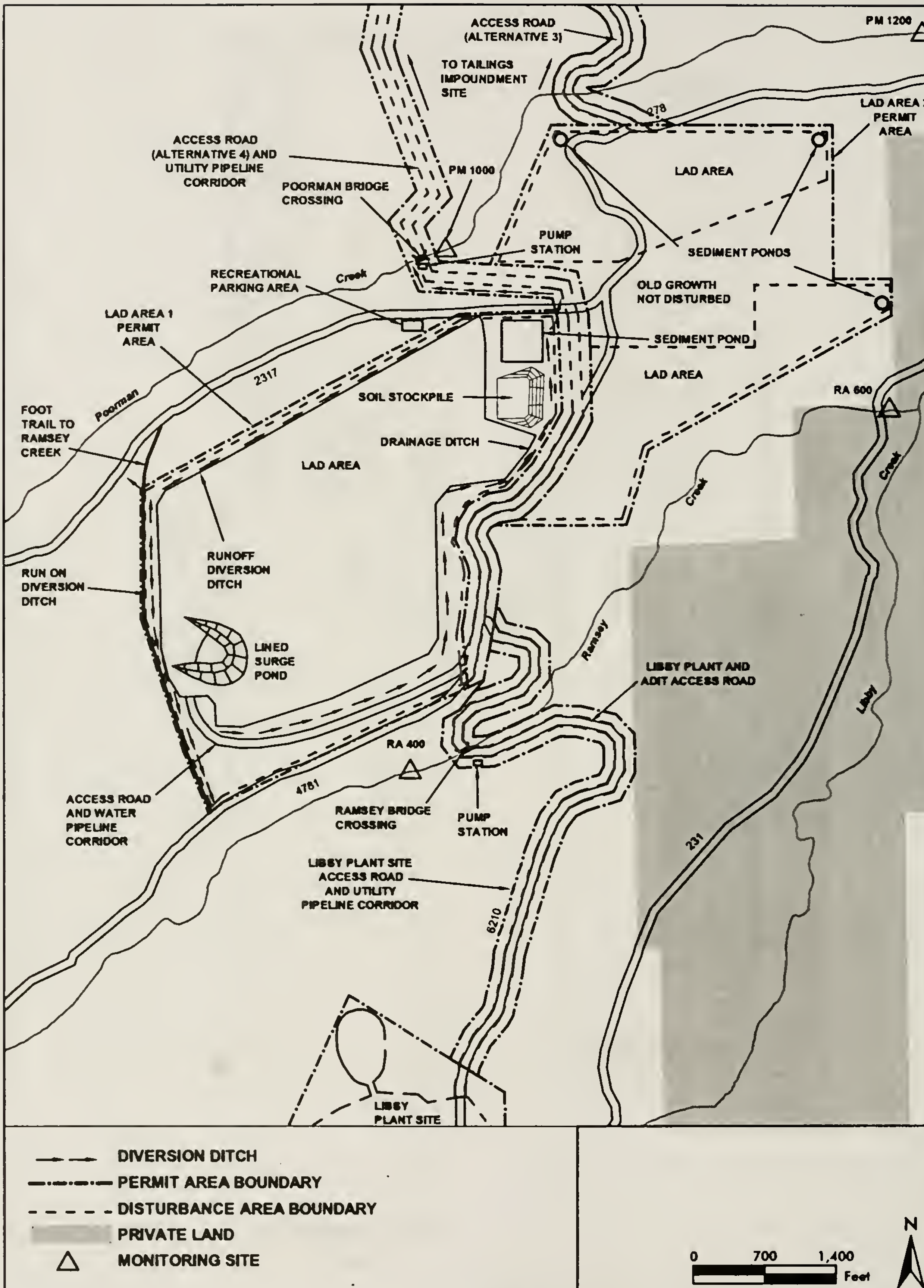


Figure 27. Poorman Tailings Impoundment Cross Sections



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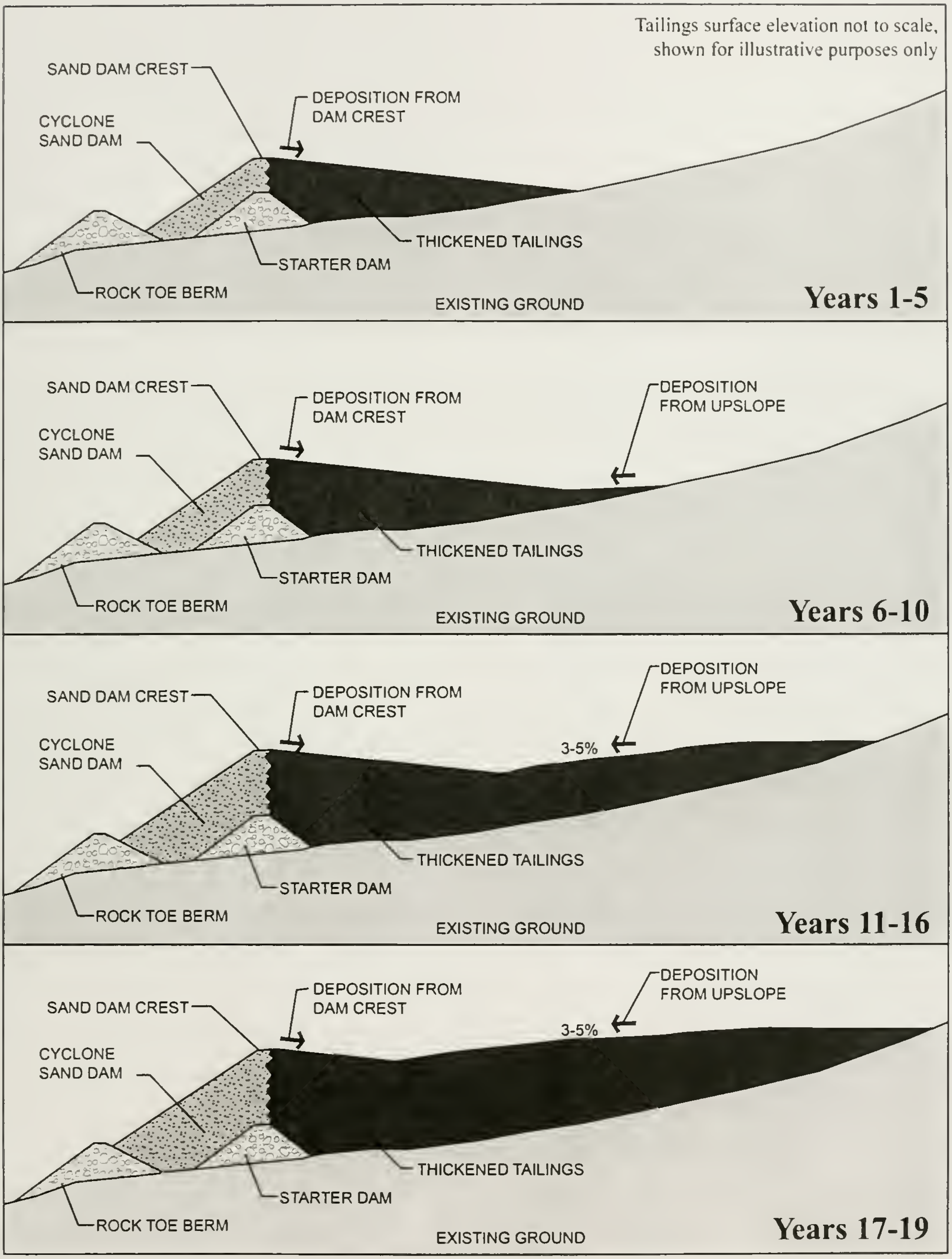

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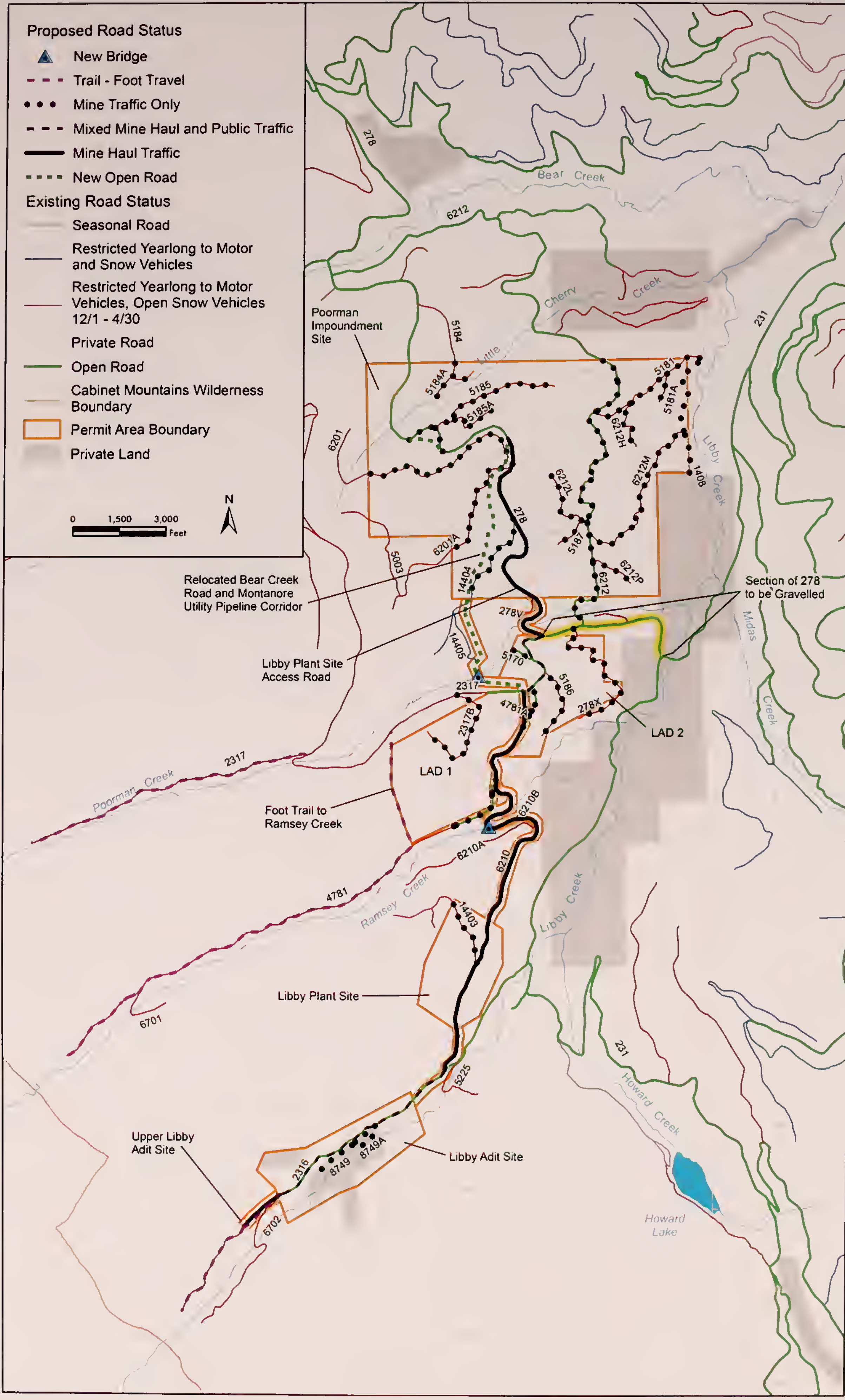


Figure 30. Roads Proposed for Use in Alternative 3

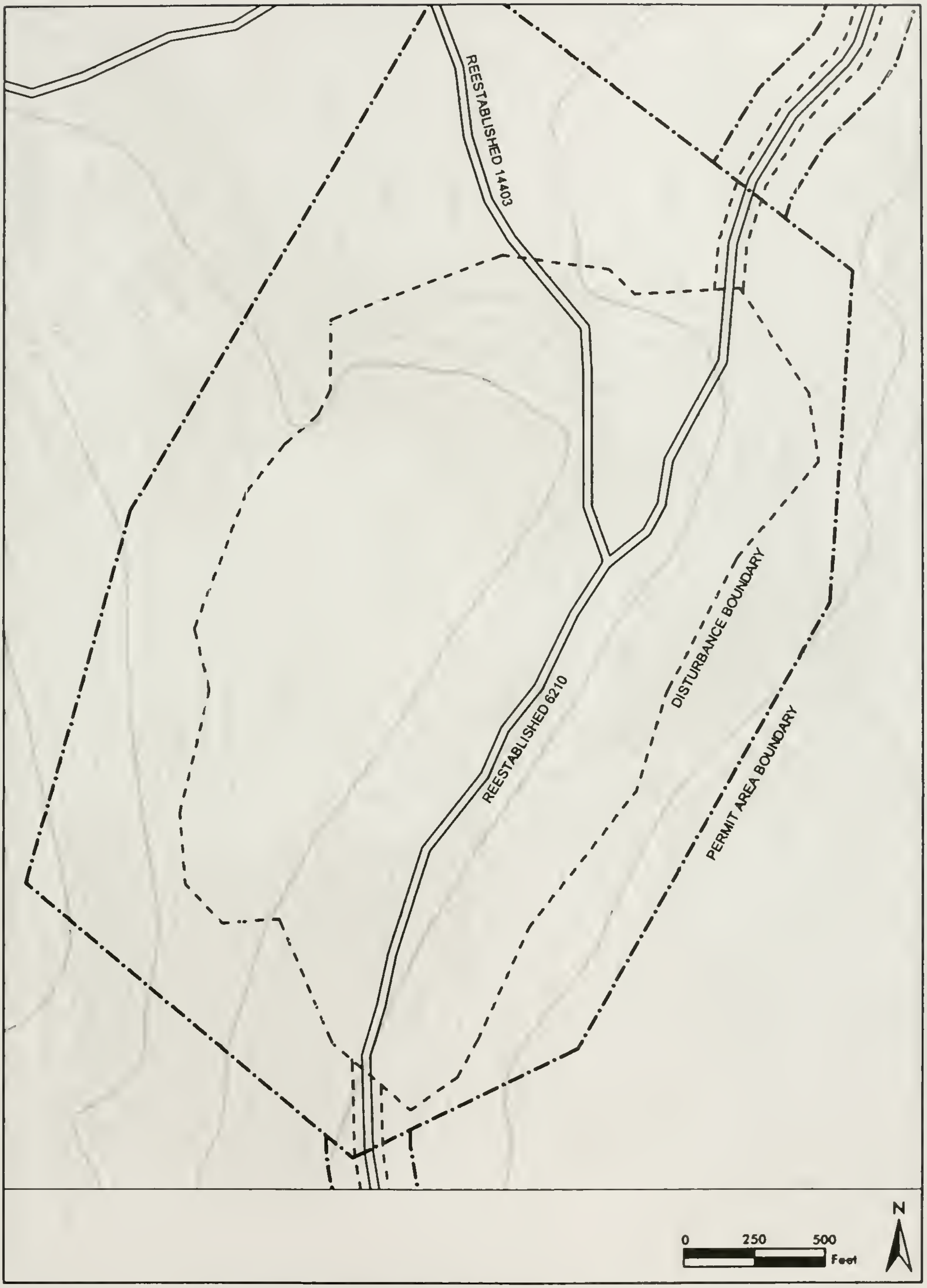


Figure 31. Post-mining Topography, Libby Plant Site, Alternatives 3 and 4

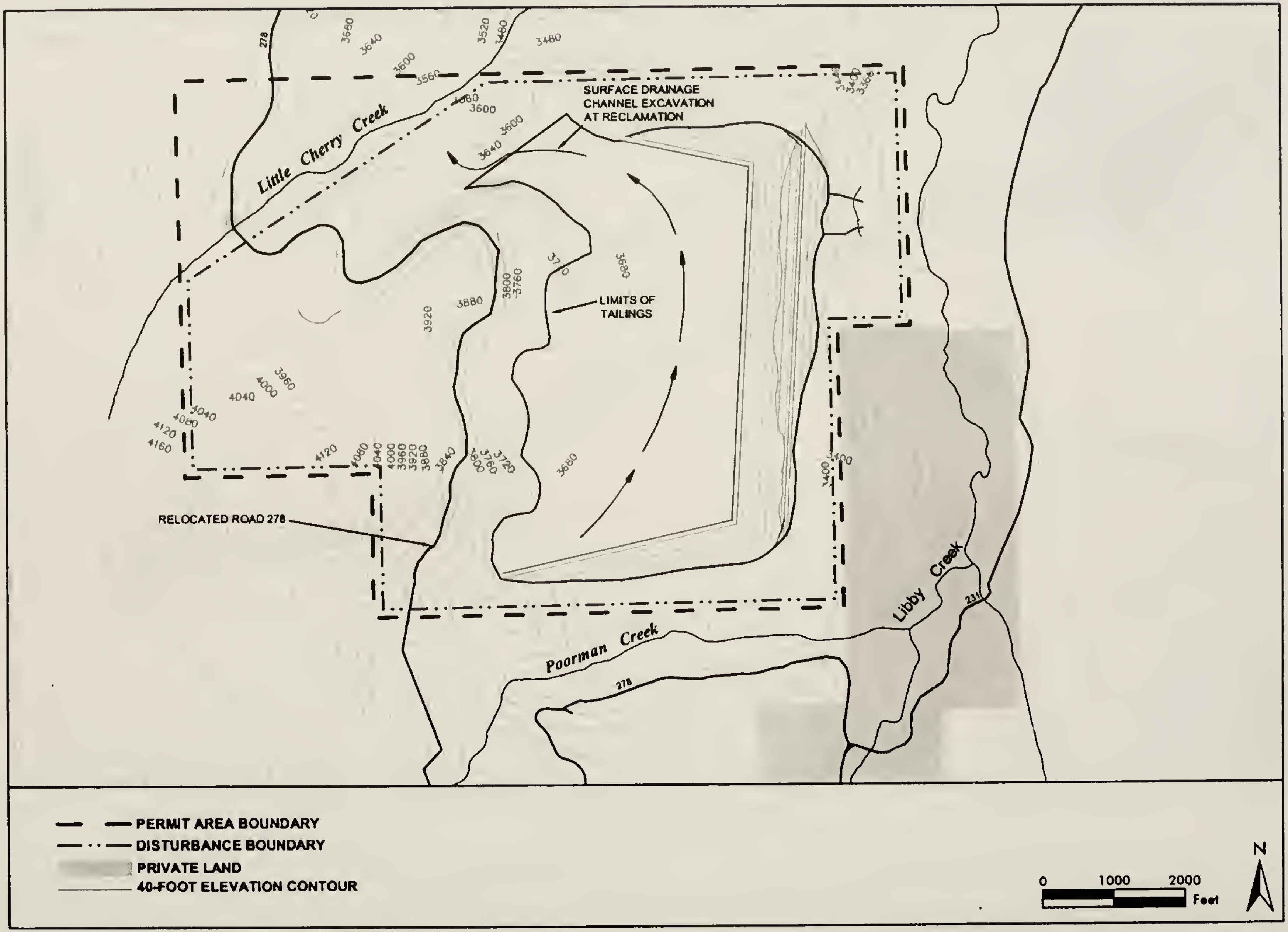


Figure 32. Post-mining Topography, Poorman Tailings Impoundment Site, Alternative 3

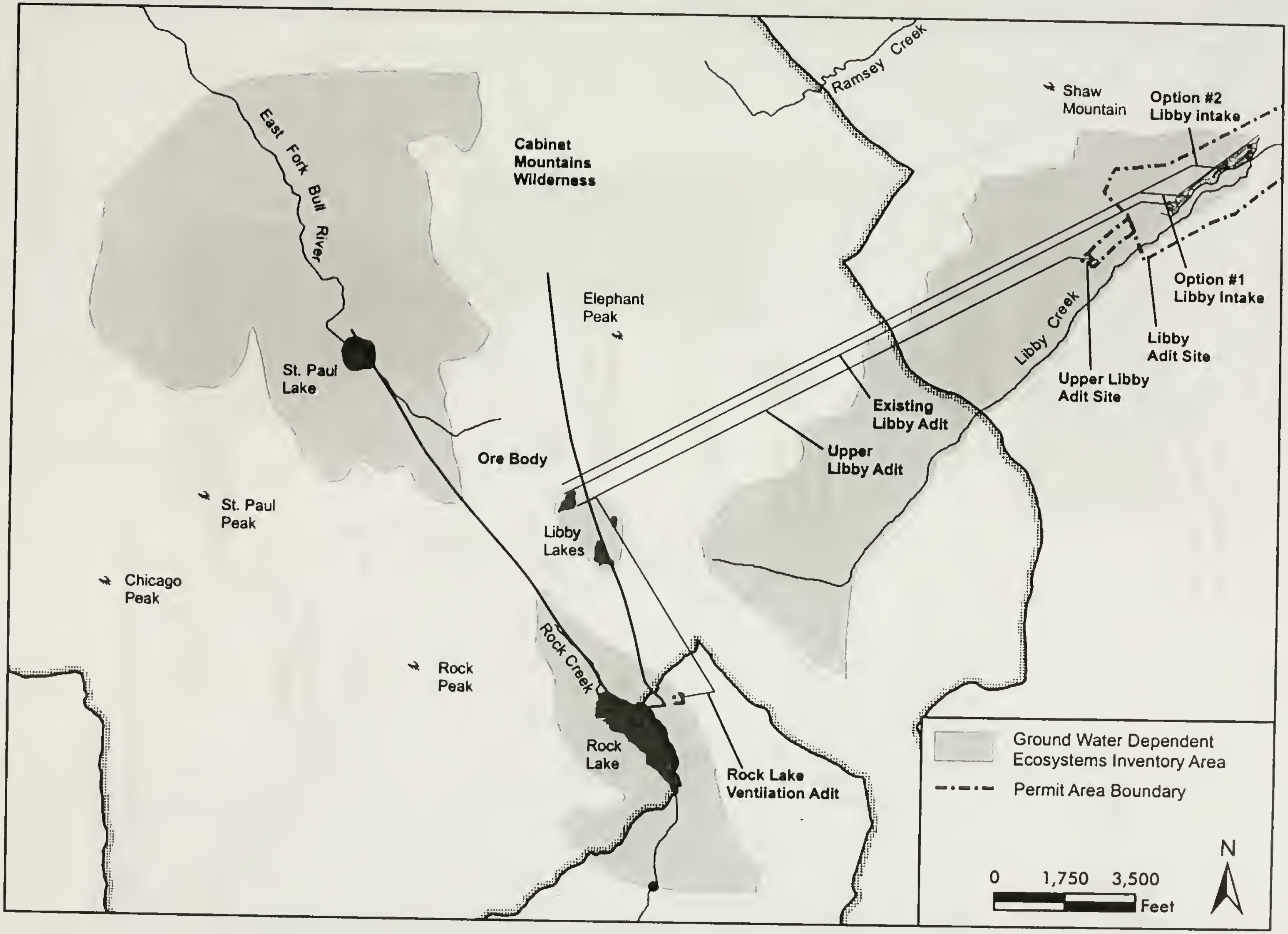
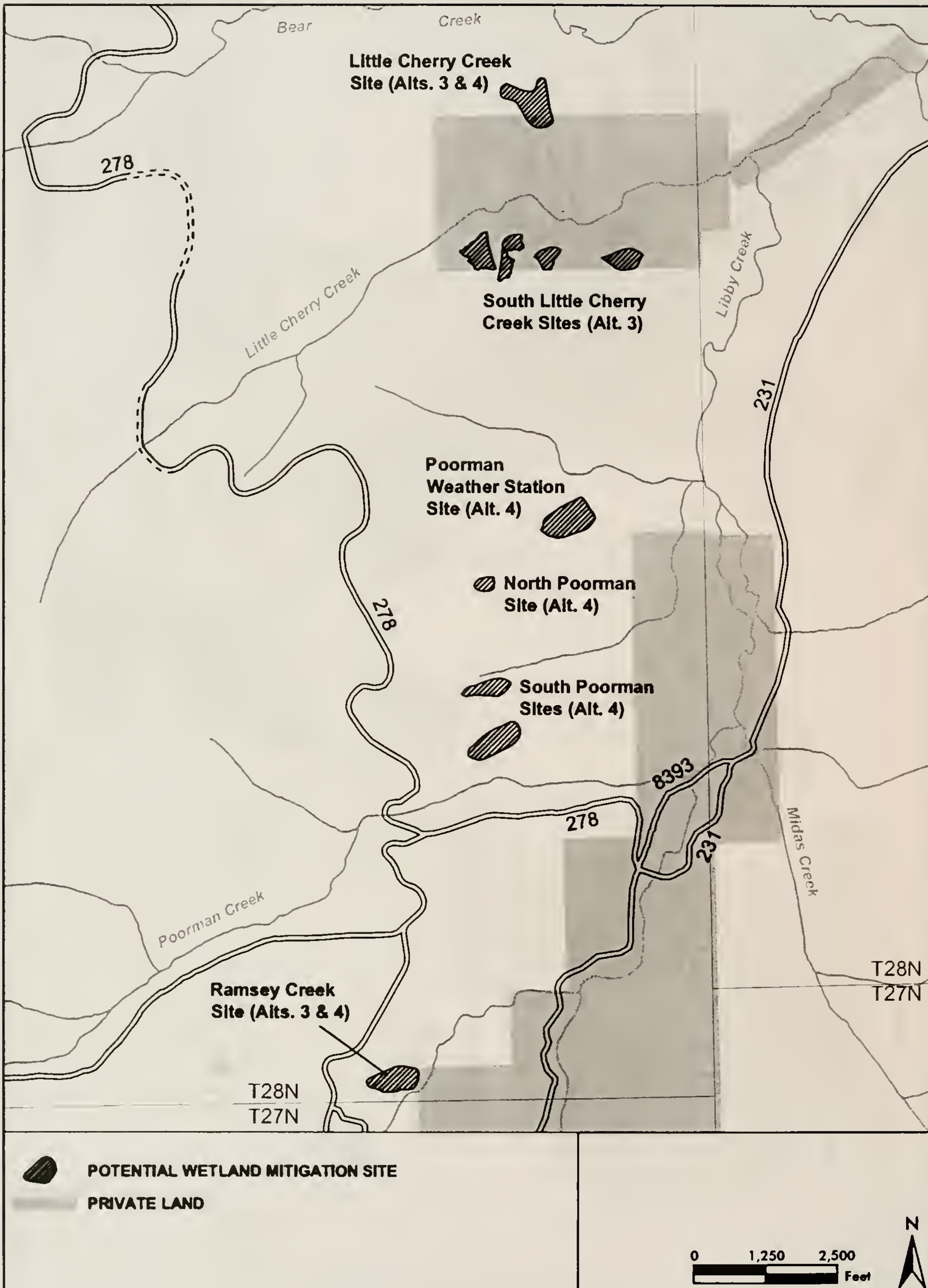


Figure 33. Gound Water Dependent Ecosystems Inventory Areas, Alternatives 3 and 4



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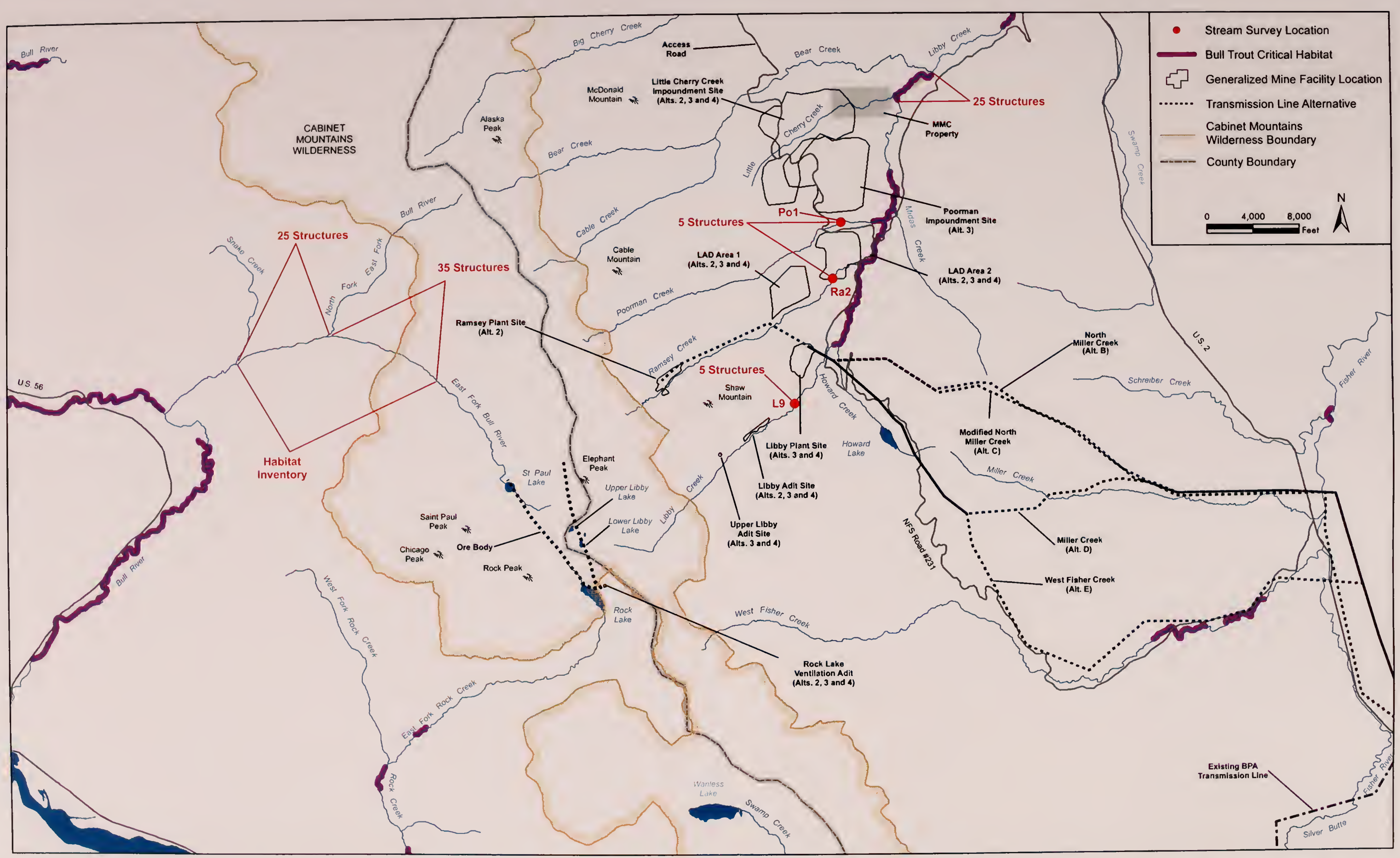

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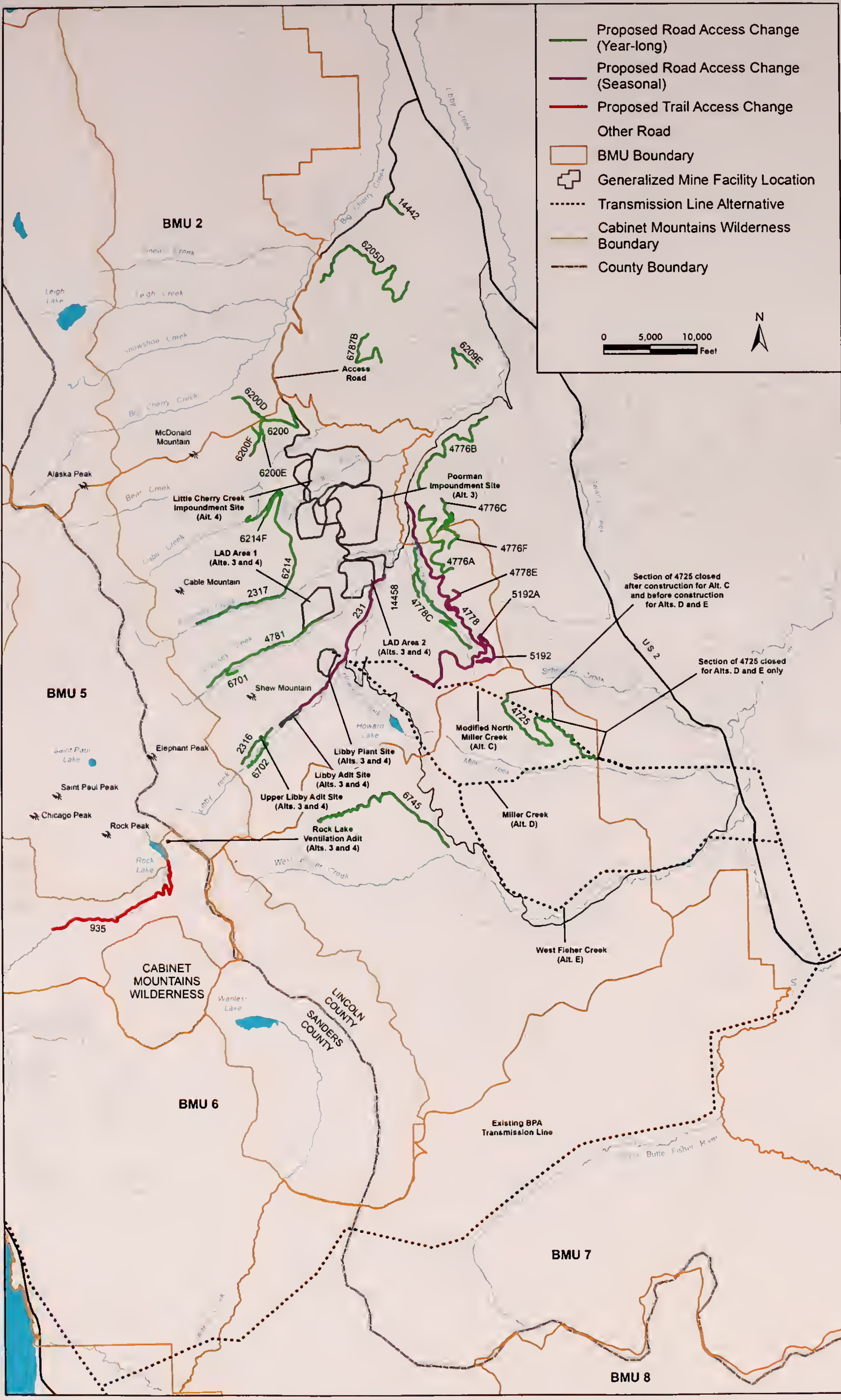


Figure 36. KNF Proposed Road and Trail Access Changes for Wildlife Mitigation, Alternatives 3, 4, C, D, and E

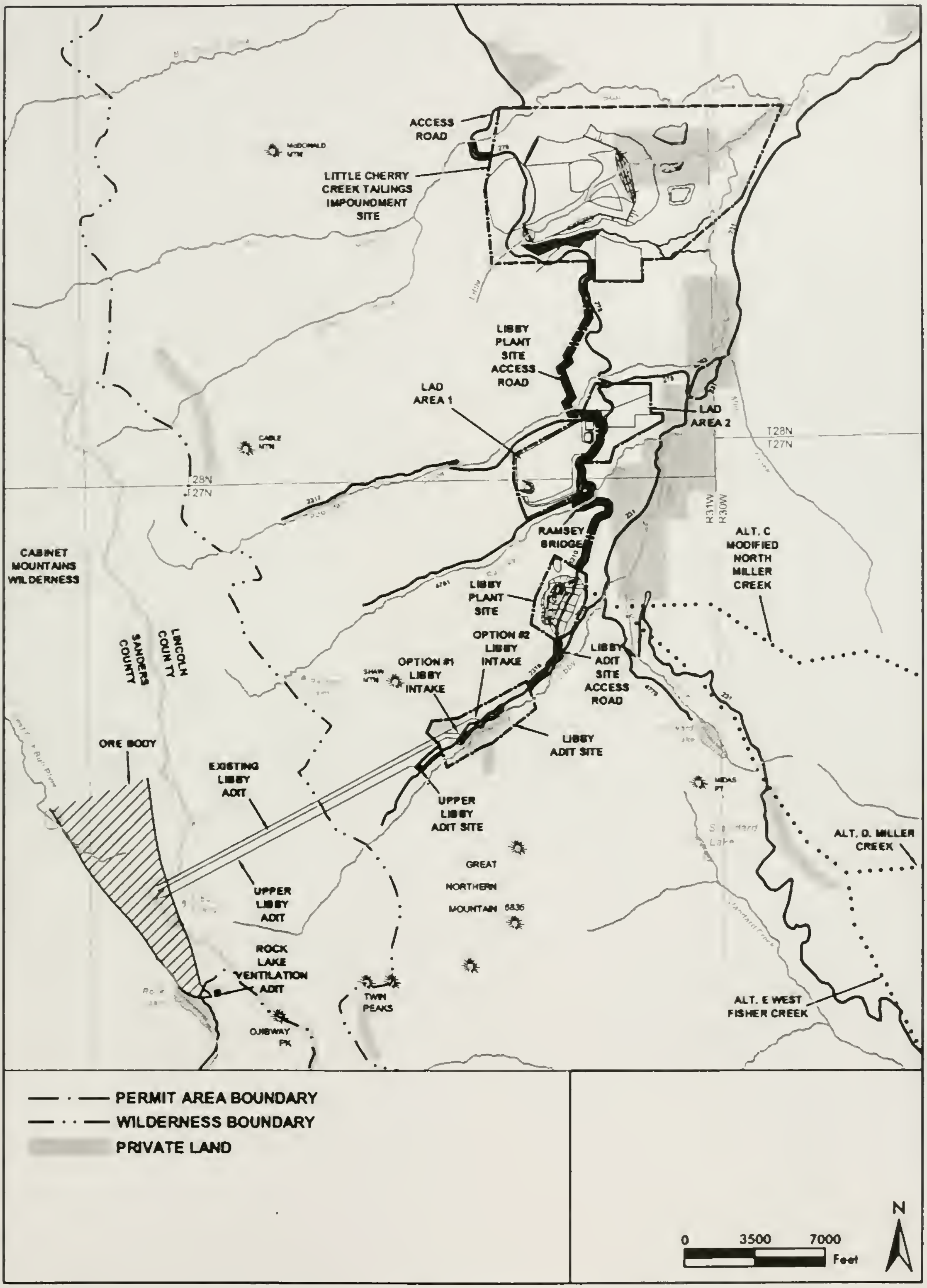


Figure 37. Mine Facilities and Permit Areas, Alternative 4

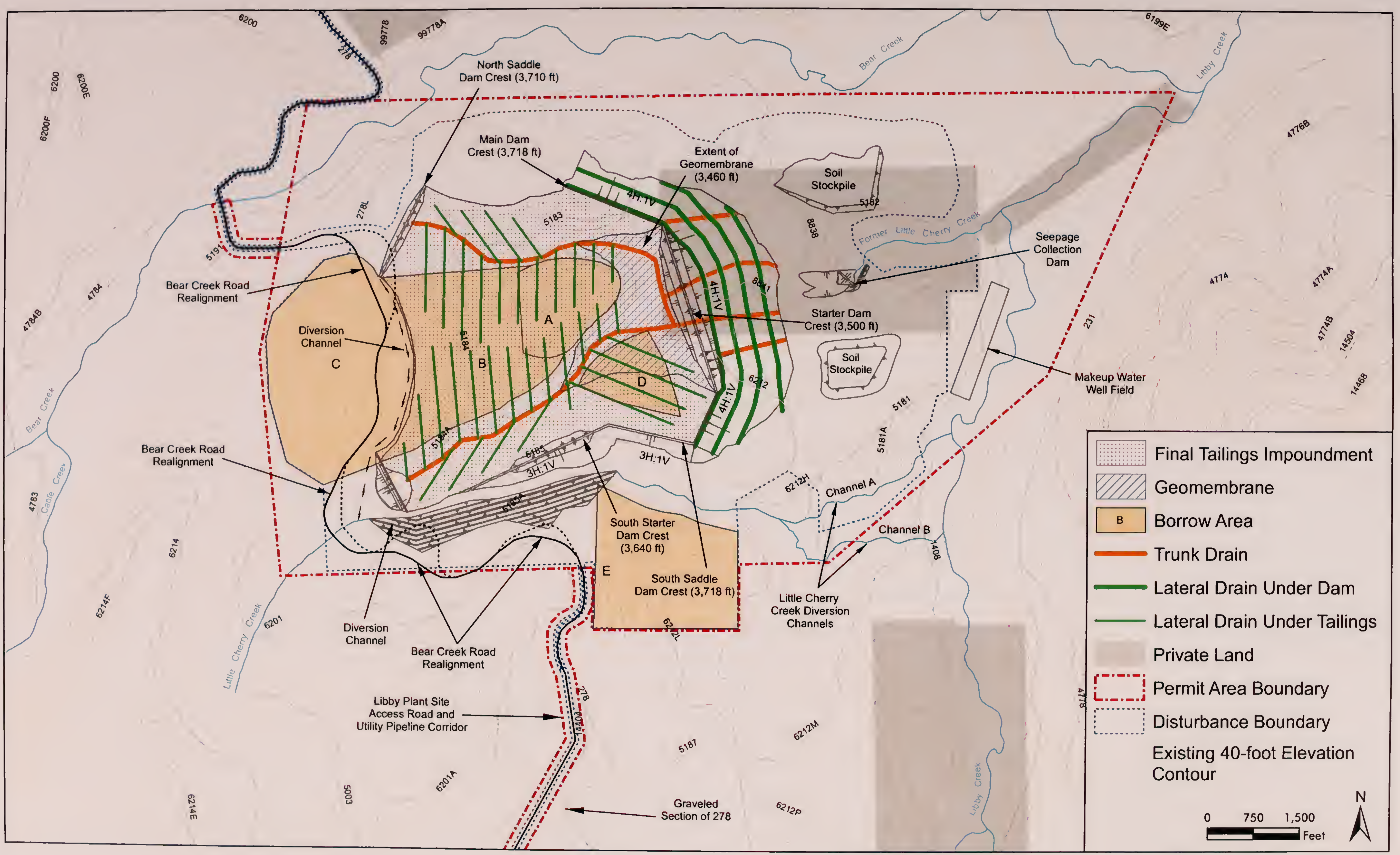


Figure 38. Little Cherry Creek Tailings Impoundment Site, Alternative 4

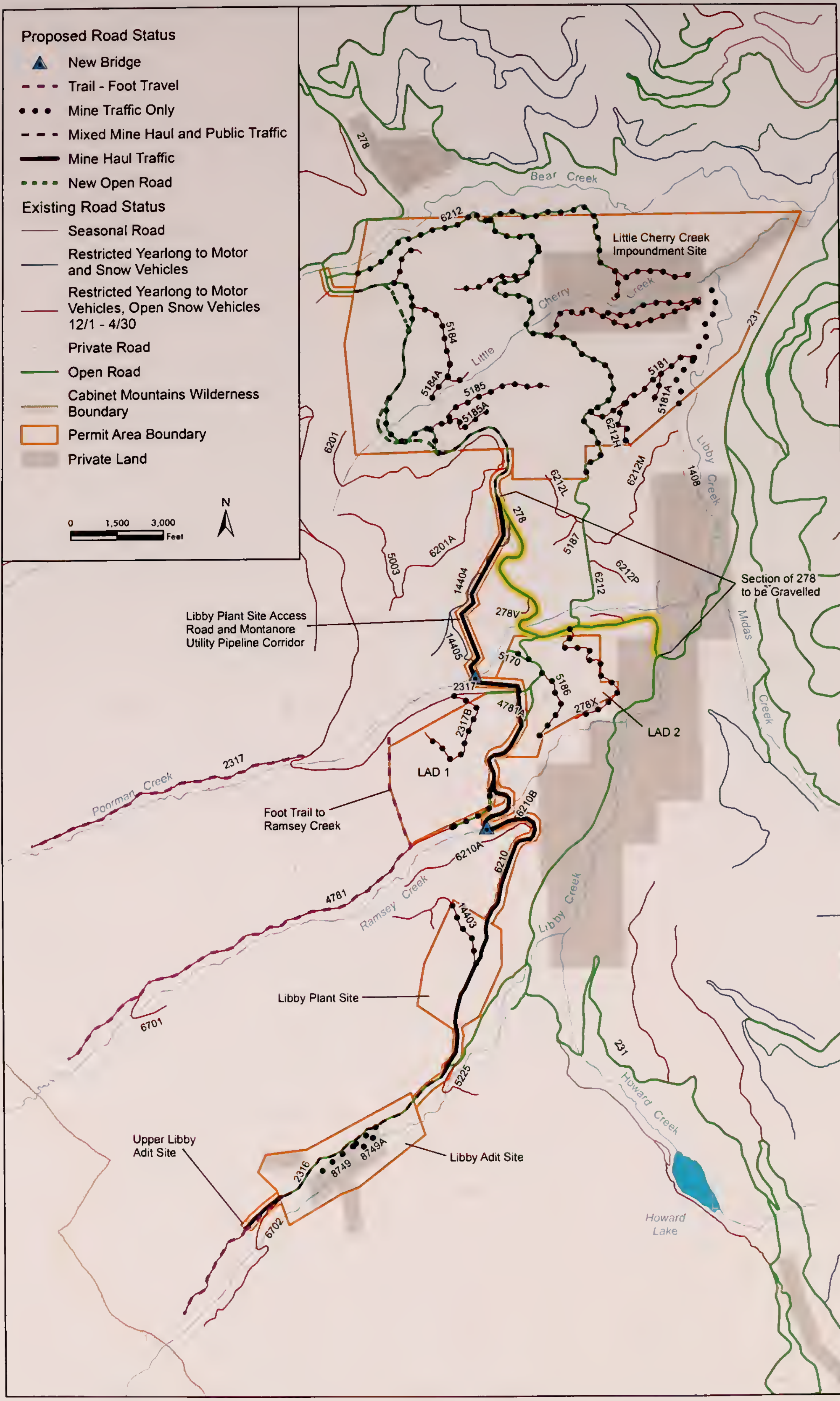


Figure 39. Roads Proposed for Use in Alternative 4

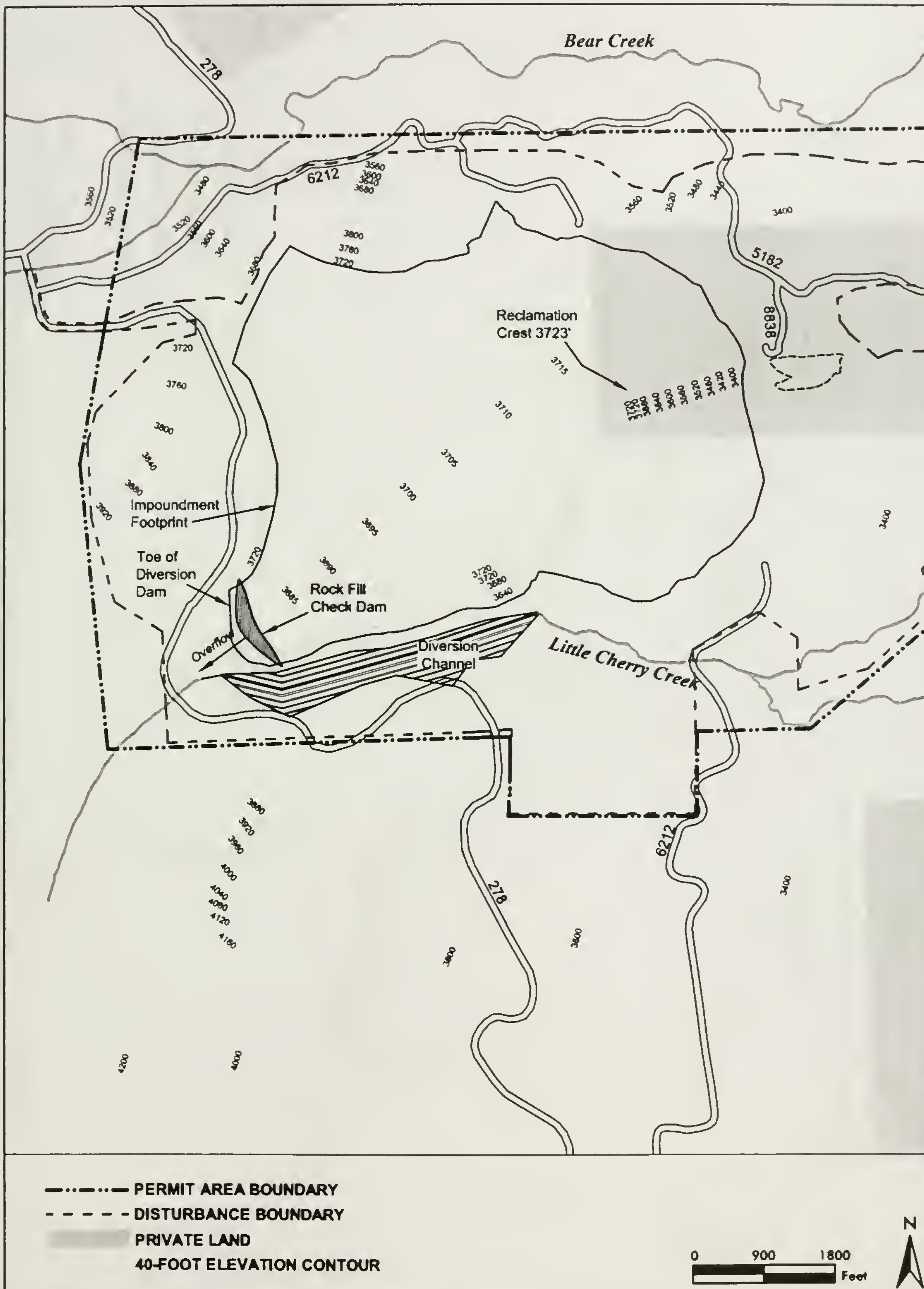
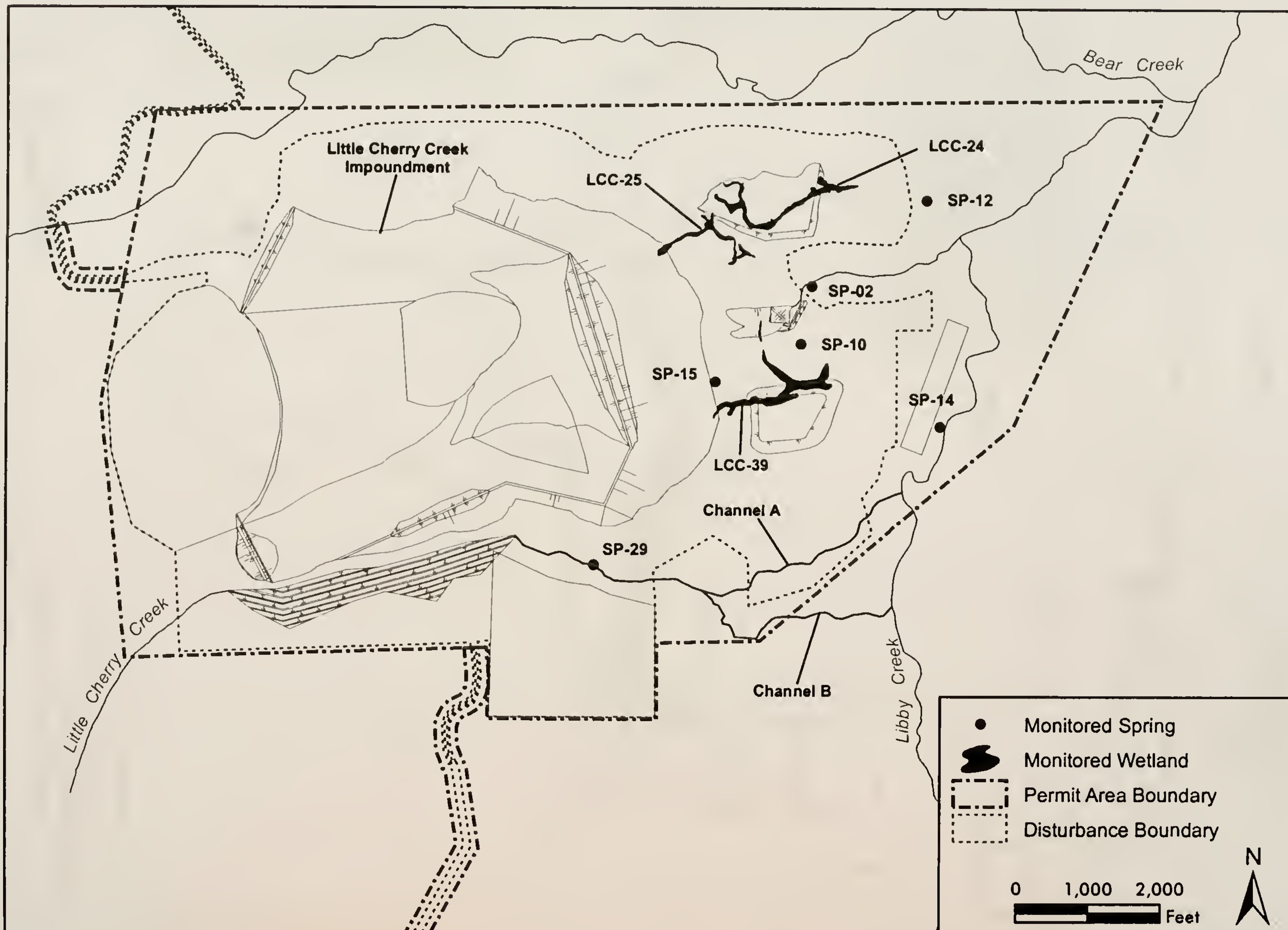


Figure 40. Post-mining Topography, Little Cherry Creek Tailings Impoundment Site, Alternative 4



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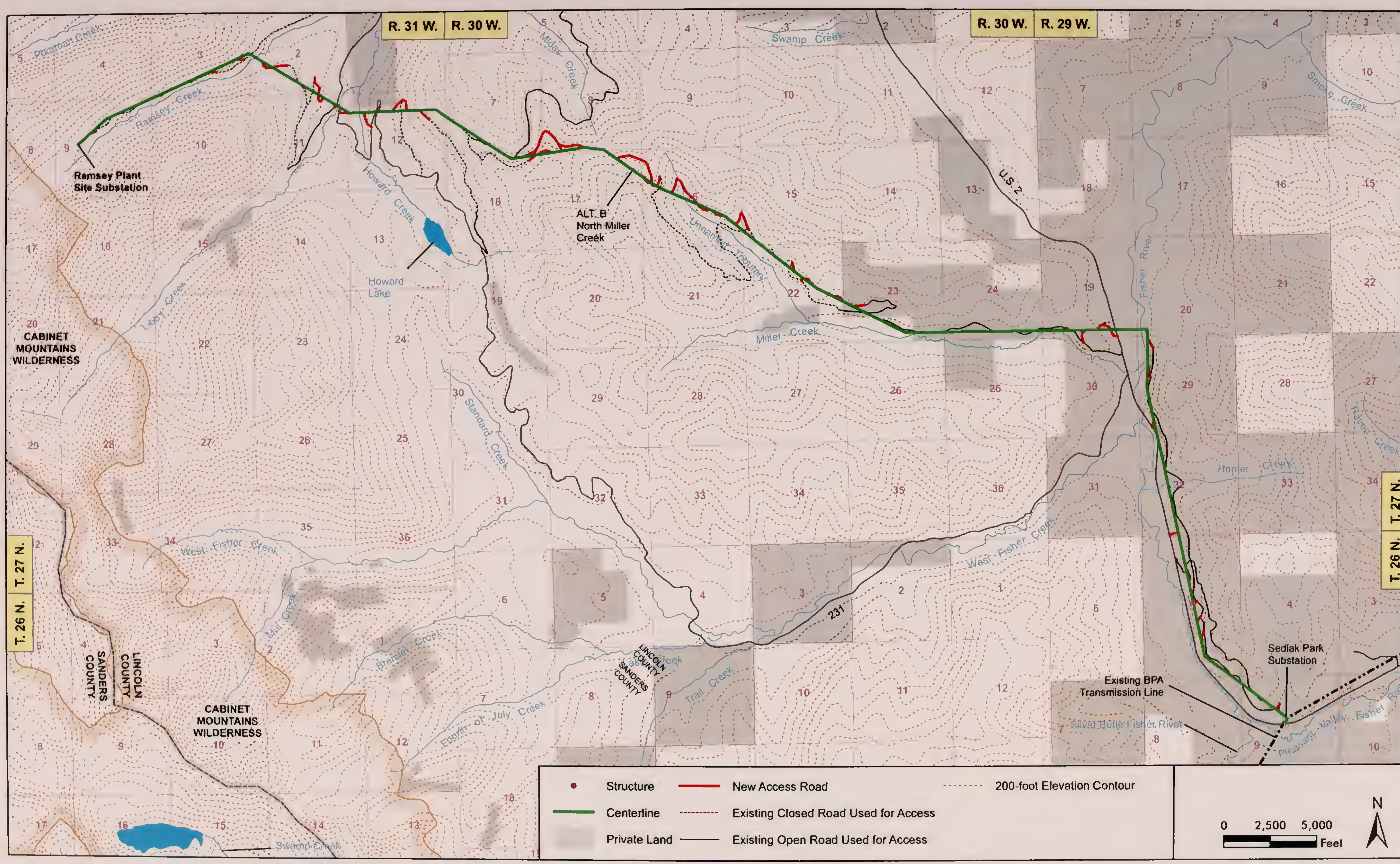


Figure 42. North Miller Creek Alignment, Structures, and Access Roads, Alternative B

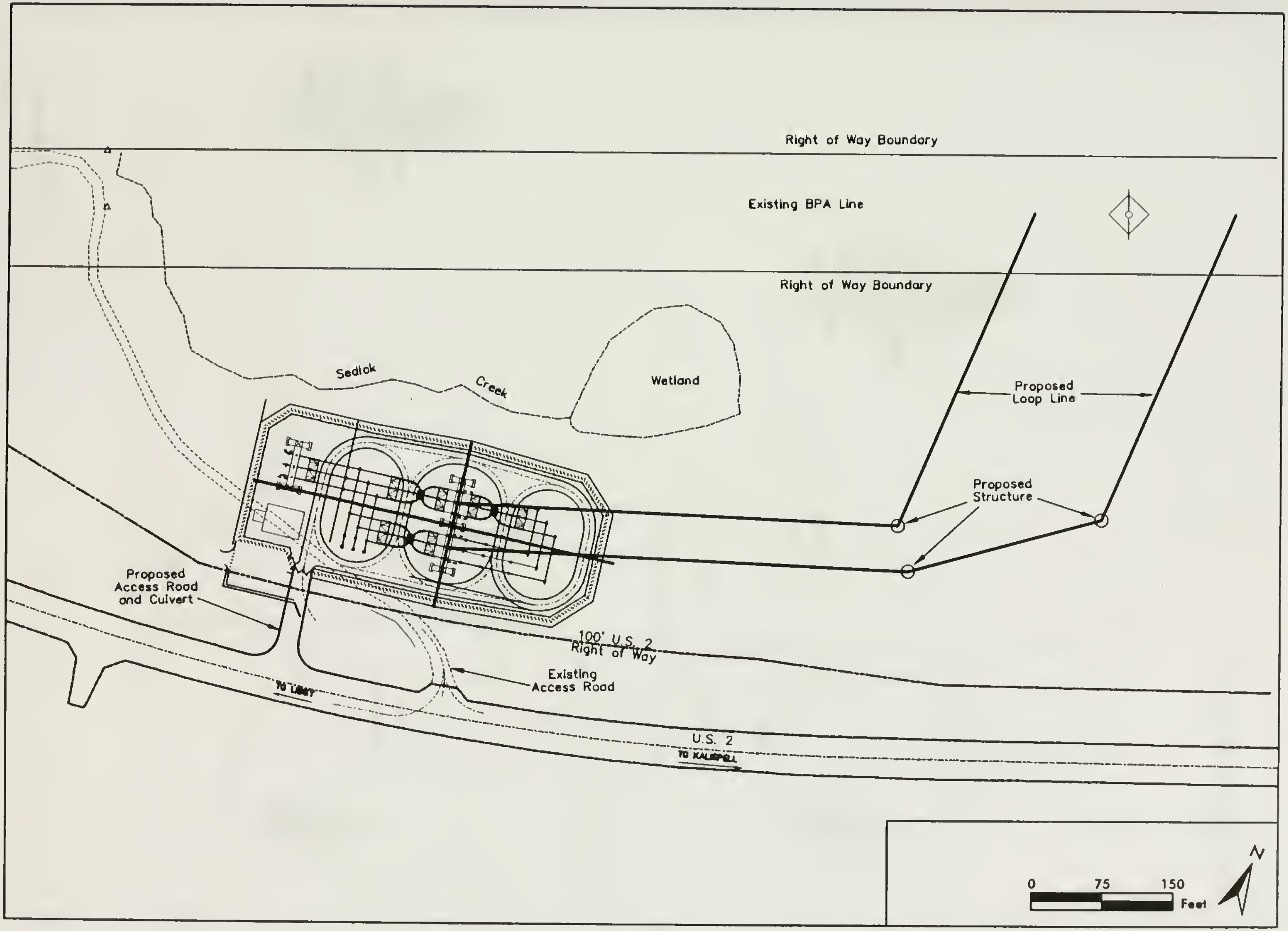


Figure 43. Sedlak Park Substation

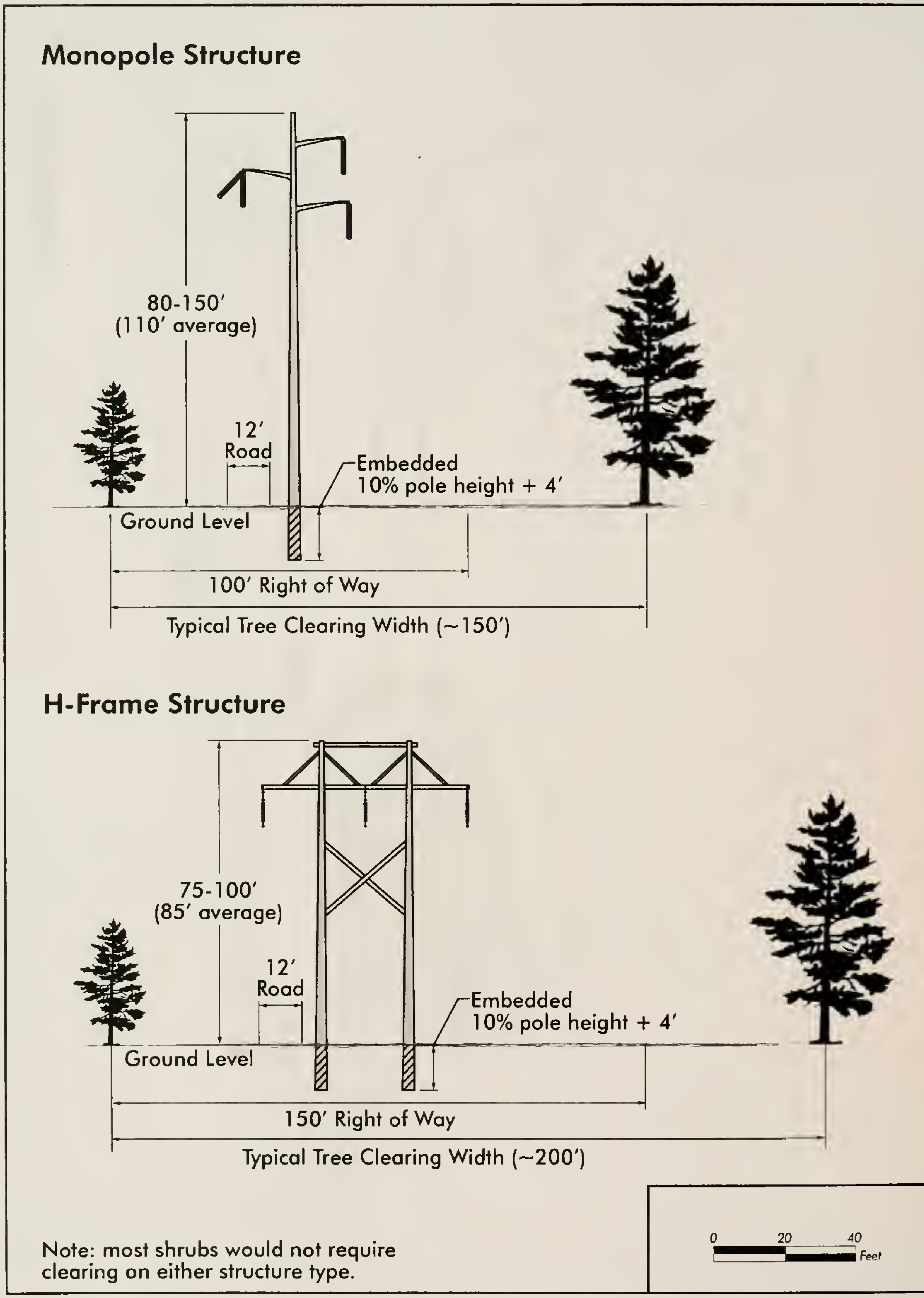


Figure 44. Transmission Line Right-of-Way and Clearing Requirements

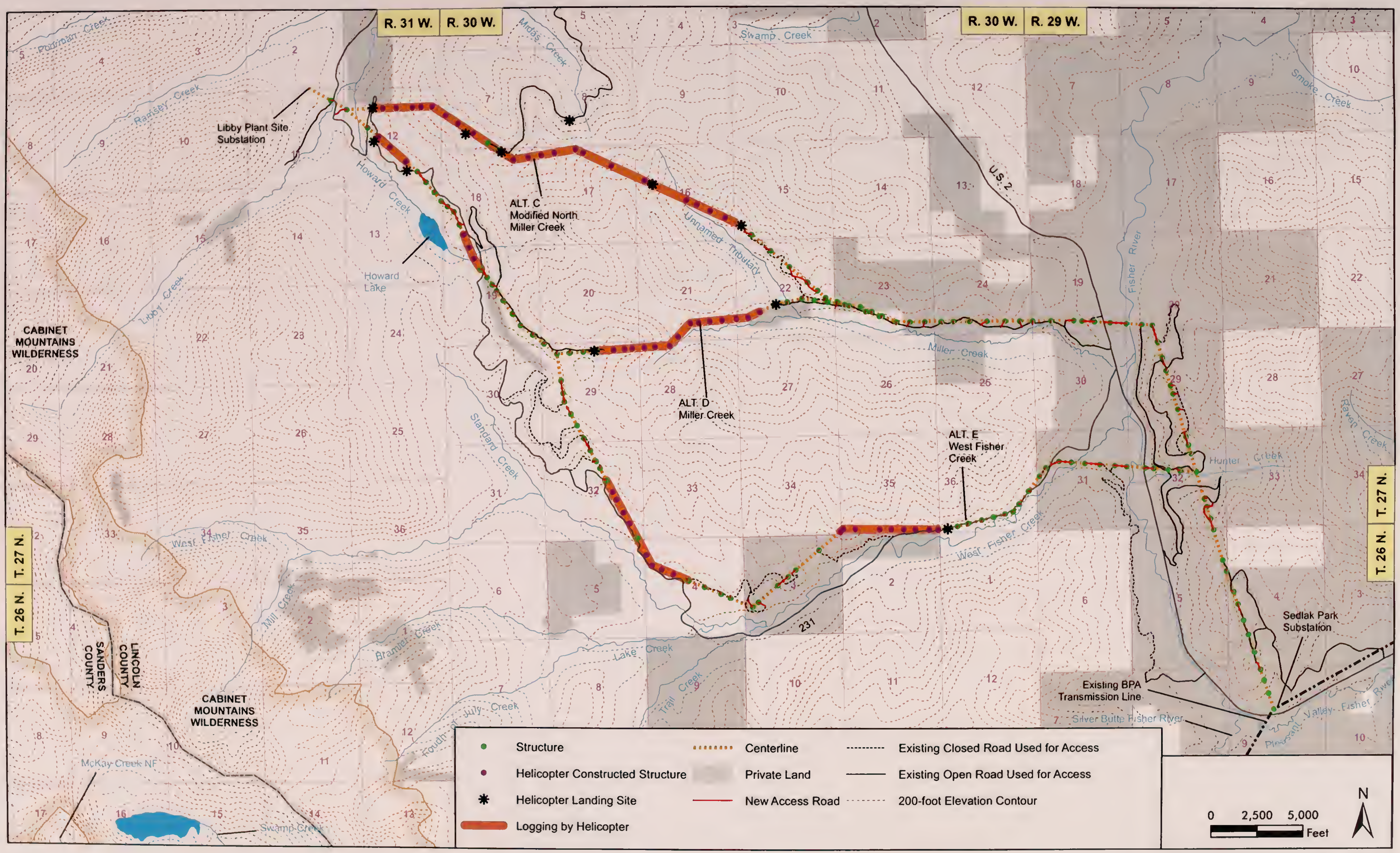


Figure 45. Transmission Line Alignment, Structures, and Access Roads, Alternatives C-E

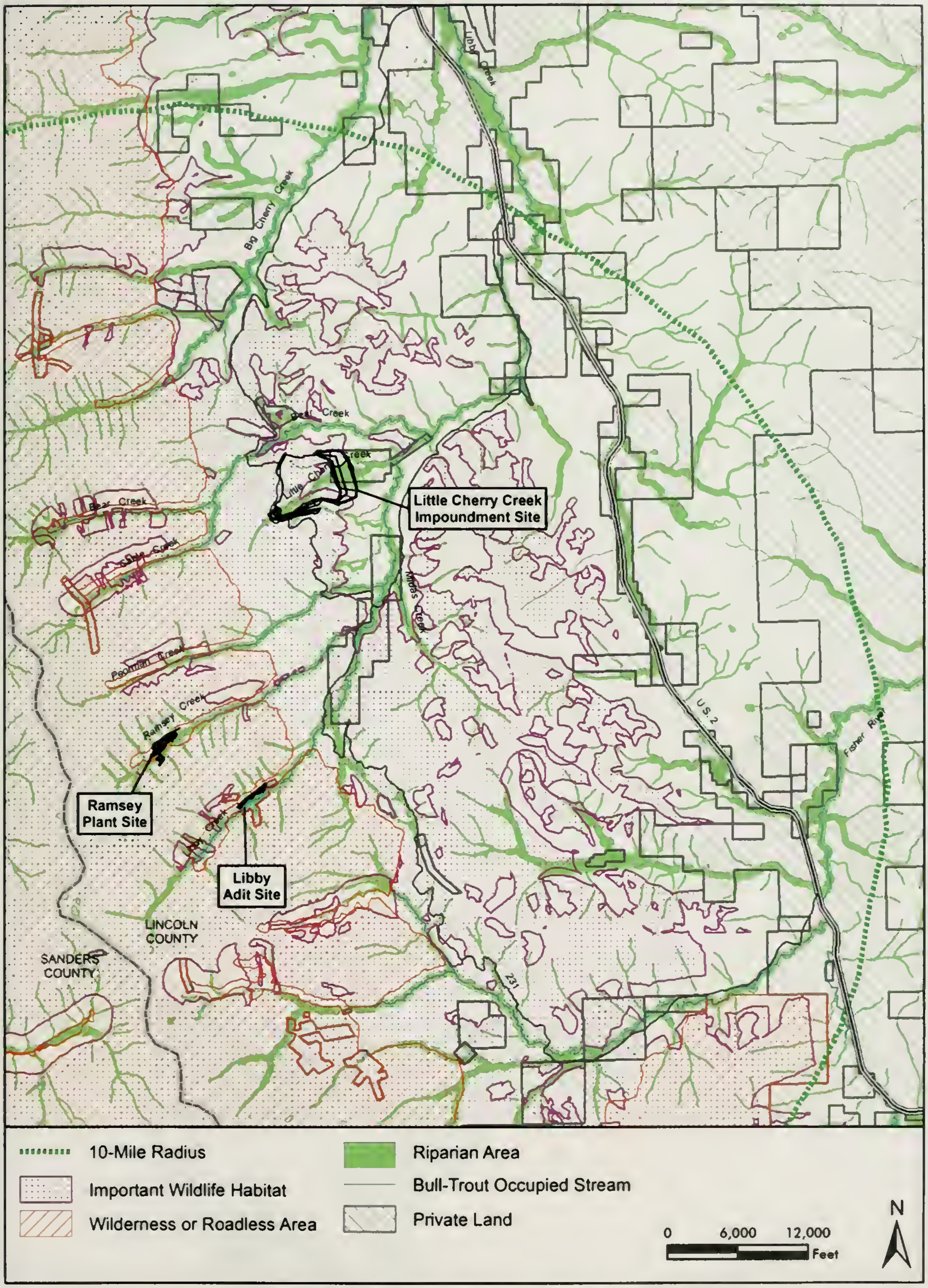


Figure 46. Key Resources Evaluated in the 2005-2007 Alternatives Analysis

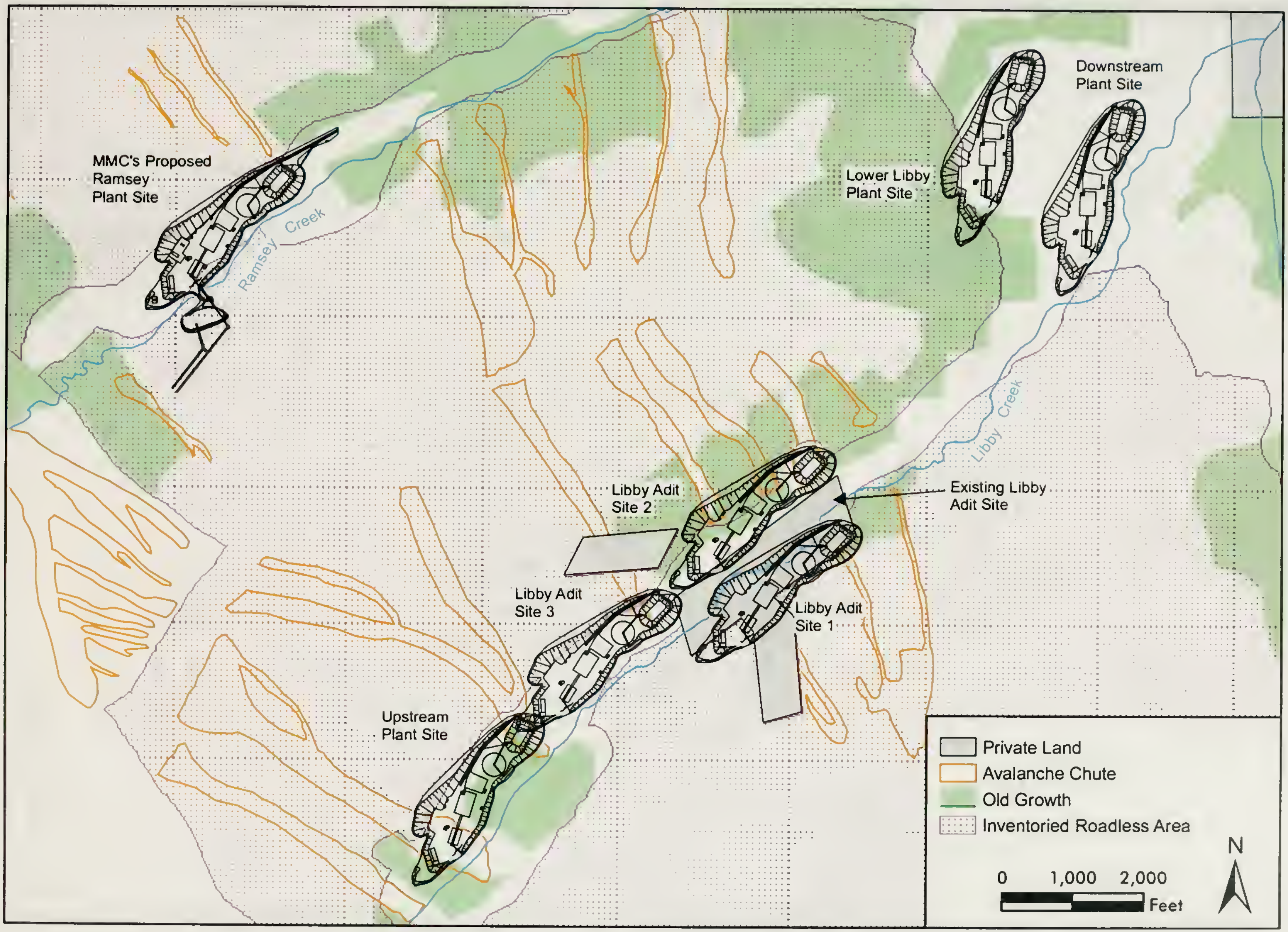


Figure 47. Plant Sites Evaluated in Upper Libby Creek for this EIS

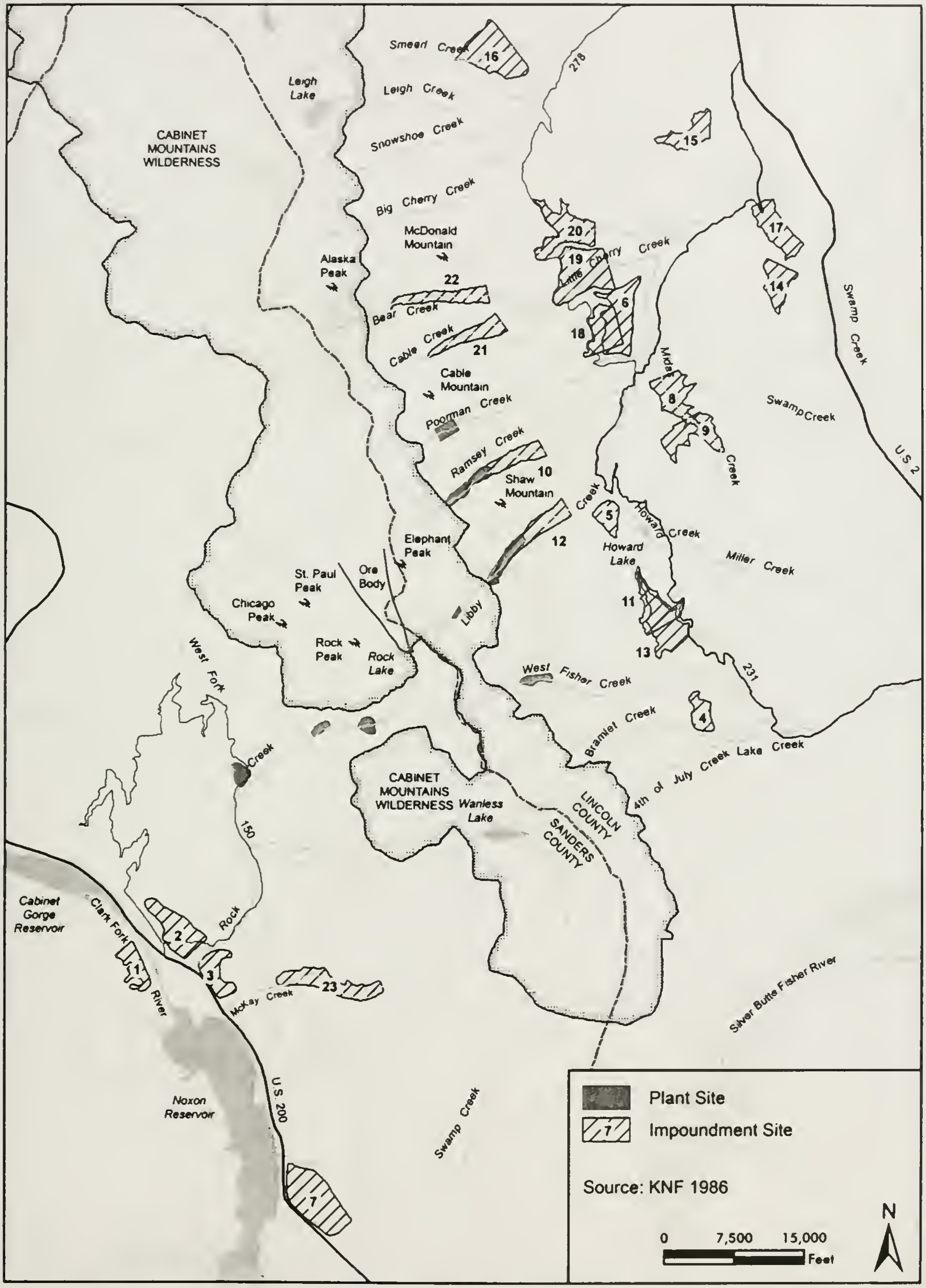


Figure 48. Plant and Impoundment Sites Evaluated in the Initial Screening

Figure 49. Tailings Impoundment Sites Evaluated in the Detailed Screening

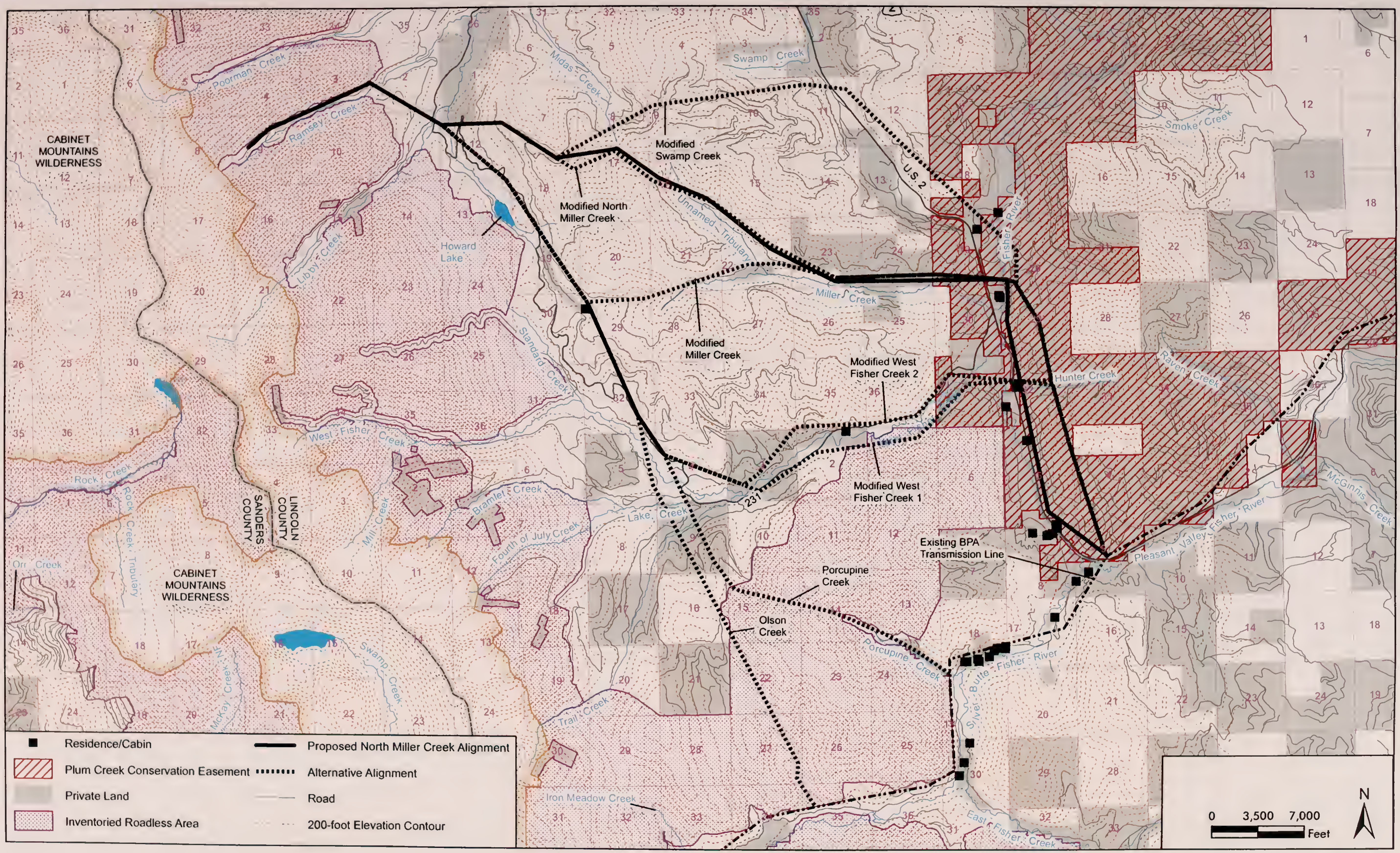


Figure 50. Transmission Line Alignment Alternatives Evaluated for this EIS

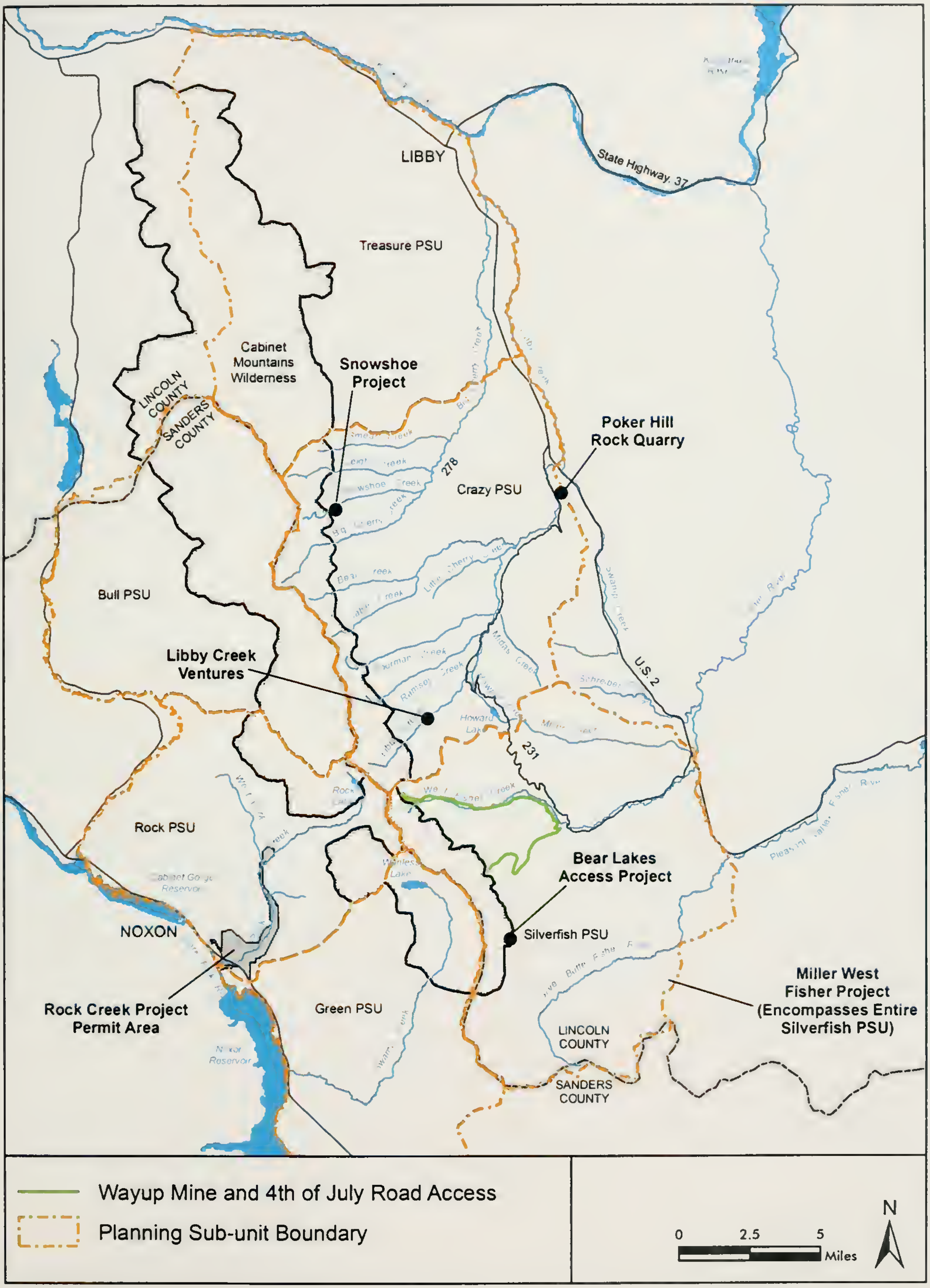


Figure 51. Past, Current and Reasonably Foreseeable Actions for the Proposed Montanore Project

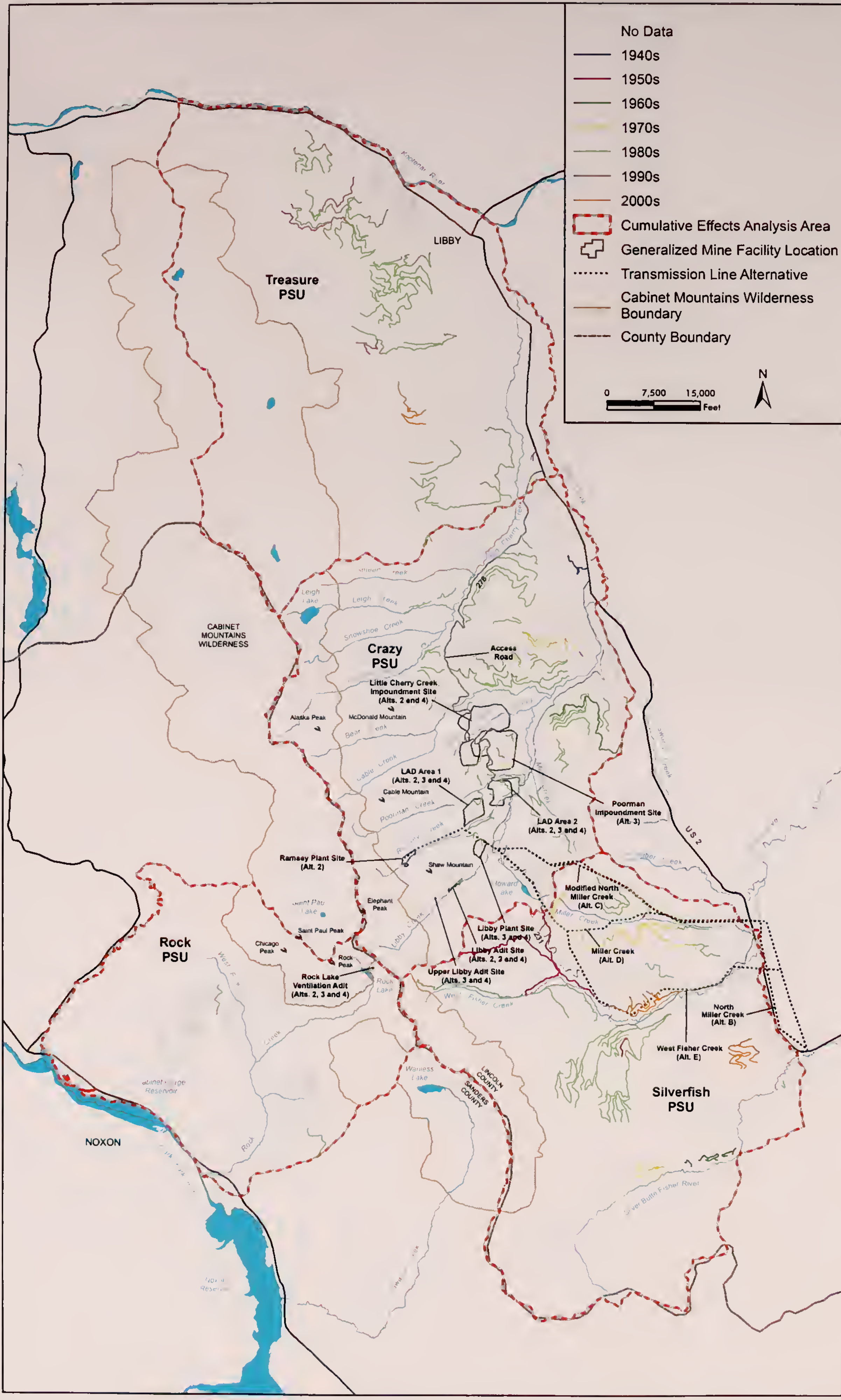


Figure 52. Road Construction by Decade in the Montanore Cumulative Effects Analysis Area

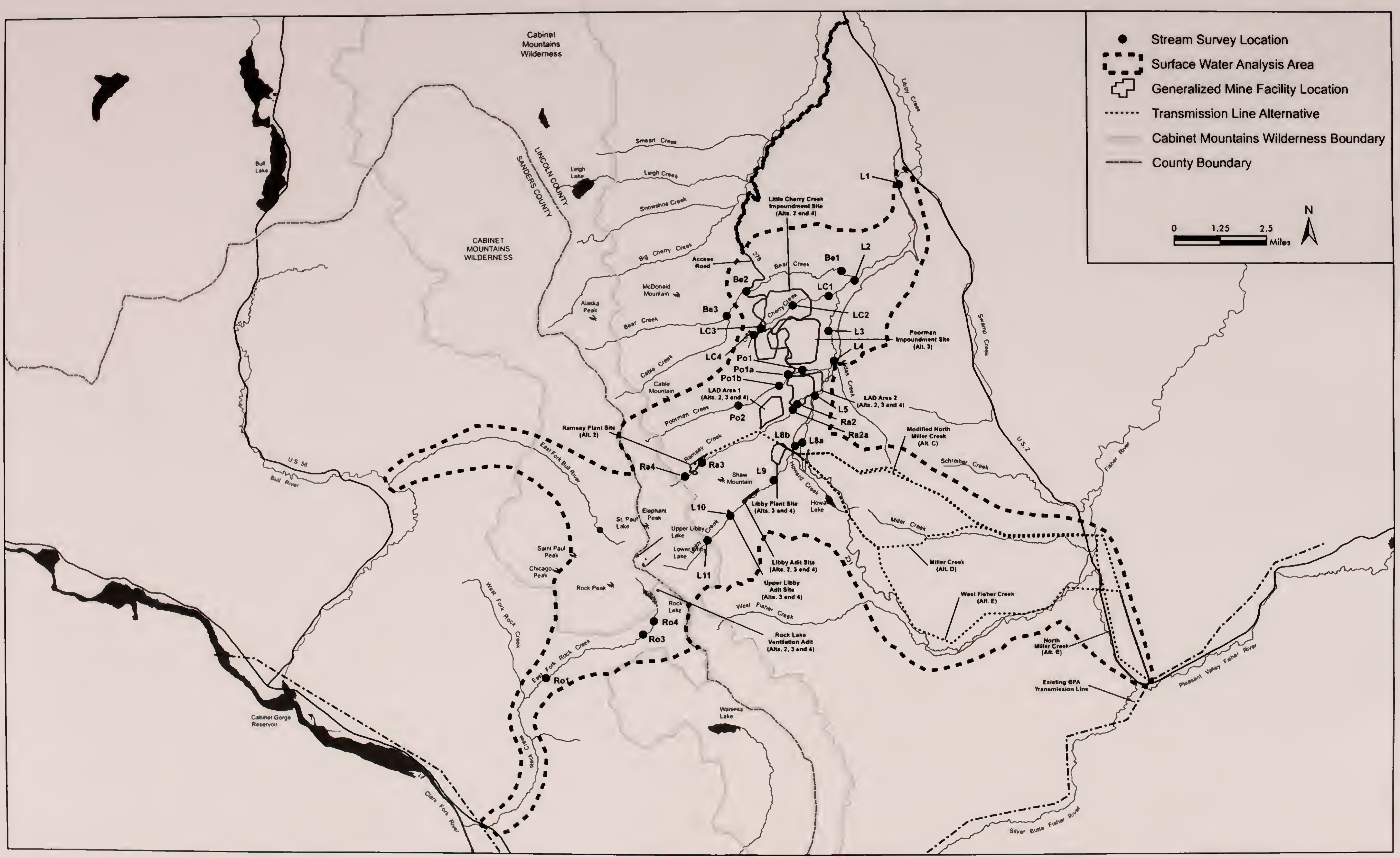


Figure 53. Stream Survey Locations in the Analysis Area

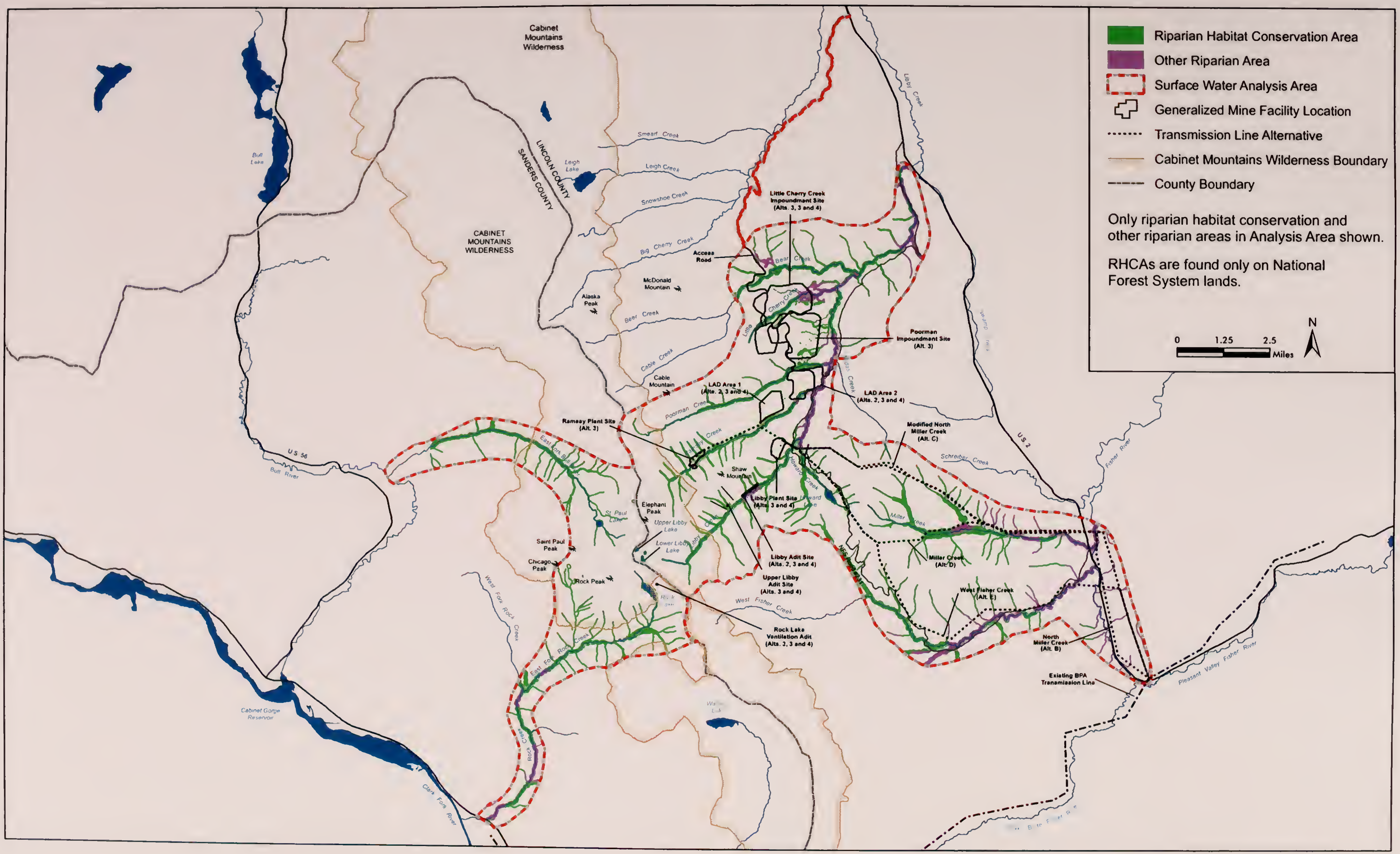


Figure 54. Riparian Habitat Conservation Areas and Other Riparian Areas in the Analysis Area

Type	General Description
A	Steep, entrenched, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel.
B	Moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks.
C	Low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplains.
D	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks.
E	Low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander width ratio.
F	Entrenched meandering riffle/pool channel on low gradients with high width/depth ratio.
G	Entrenched "gully" step/pool and low width/depth ratio on moderate gradients.

Bed Material		Slope	
1	Bedrock	a	Steep slope for stream type
2	Boulder		
3	Cobble	b	Moderate slope for stream type
4	Gravel		
5	Sand	c	Gradual slope for stream type
6	Silt or clay		

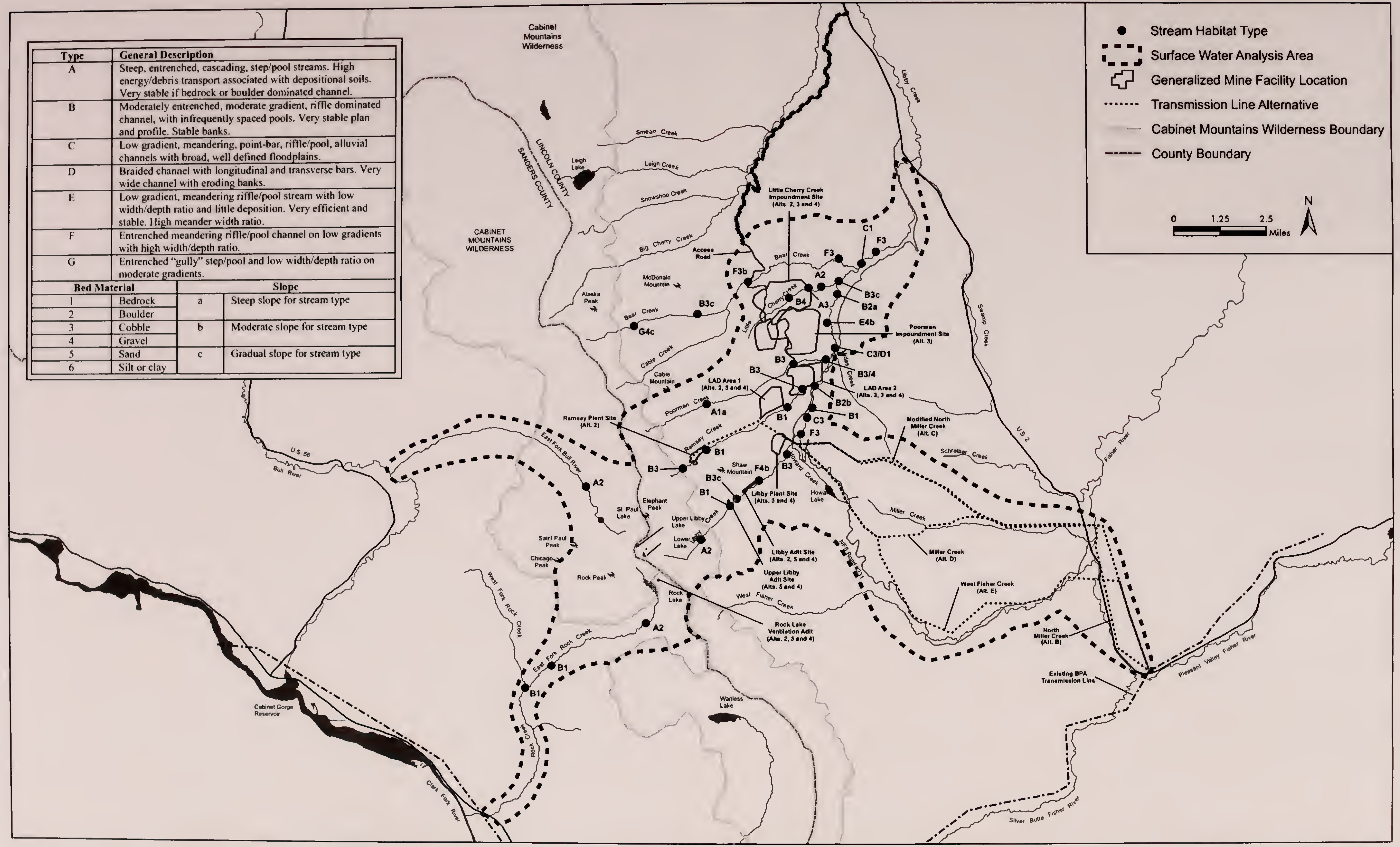


Figure 55. Stream Habitat Types of the Analysis Area Streams

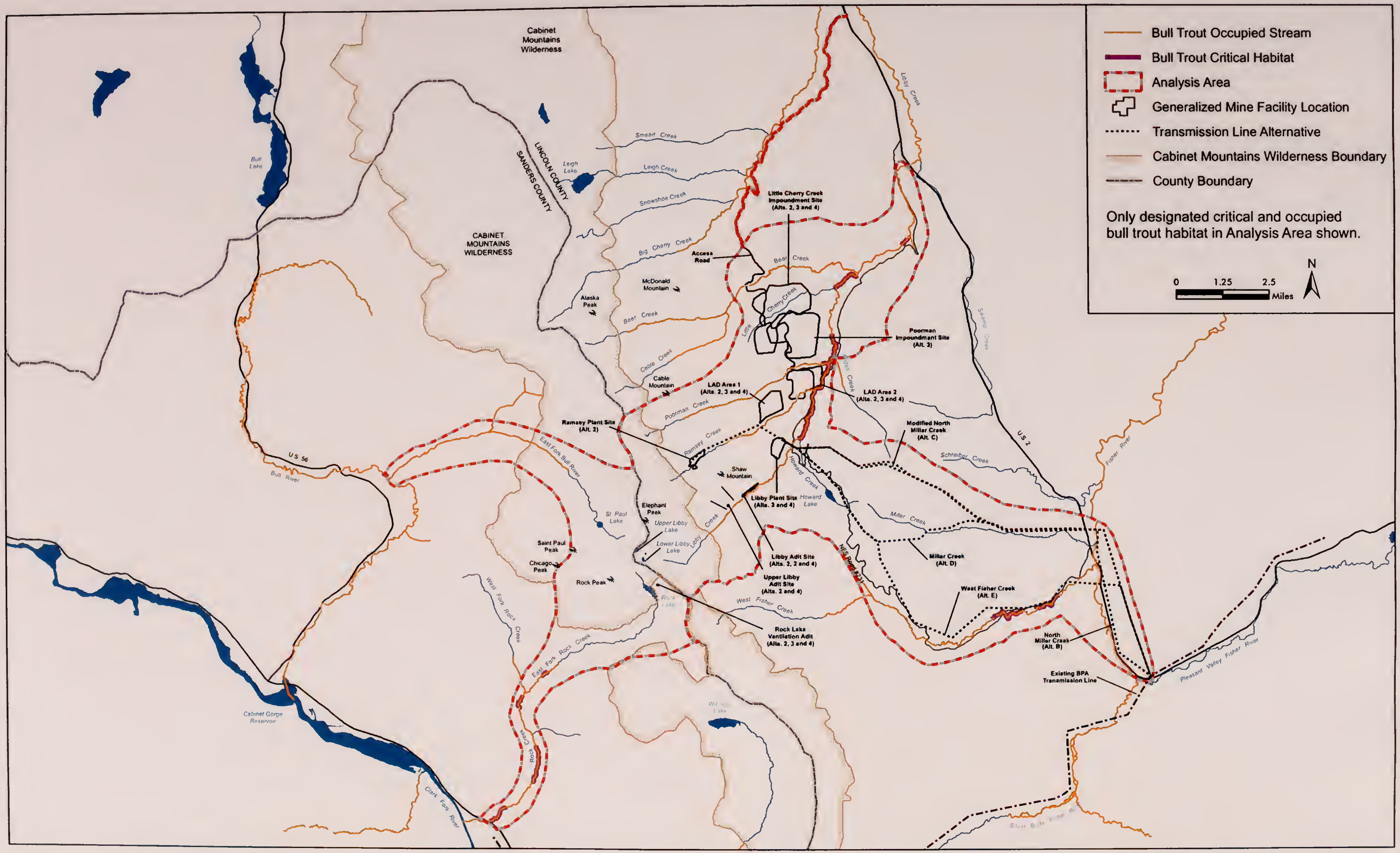


Figure 56. Designated Critical and Occupied Bull Trout Habitat in the Analysis Area Streams

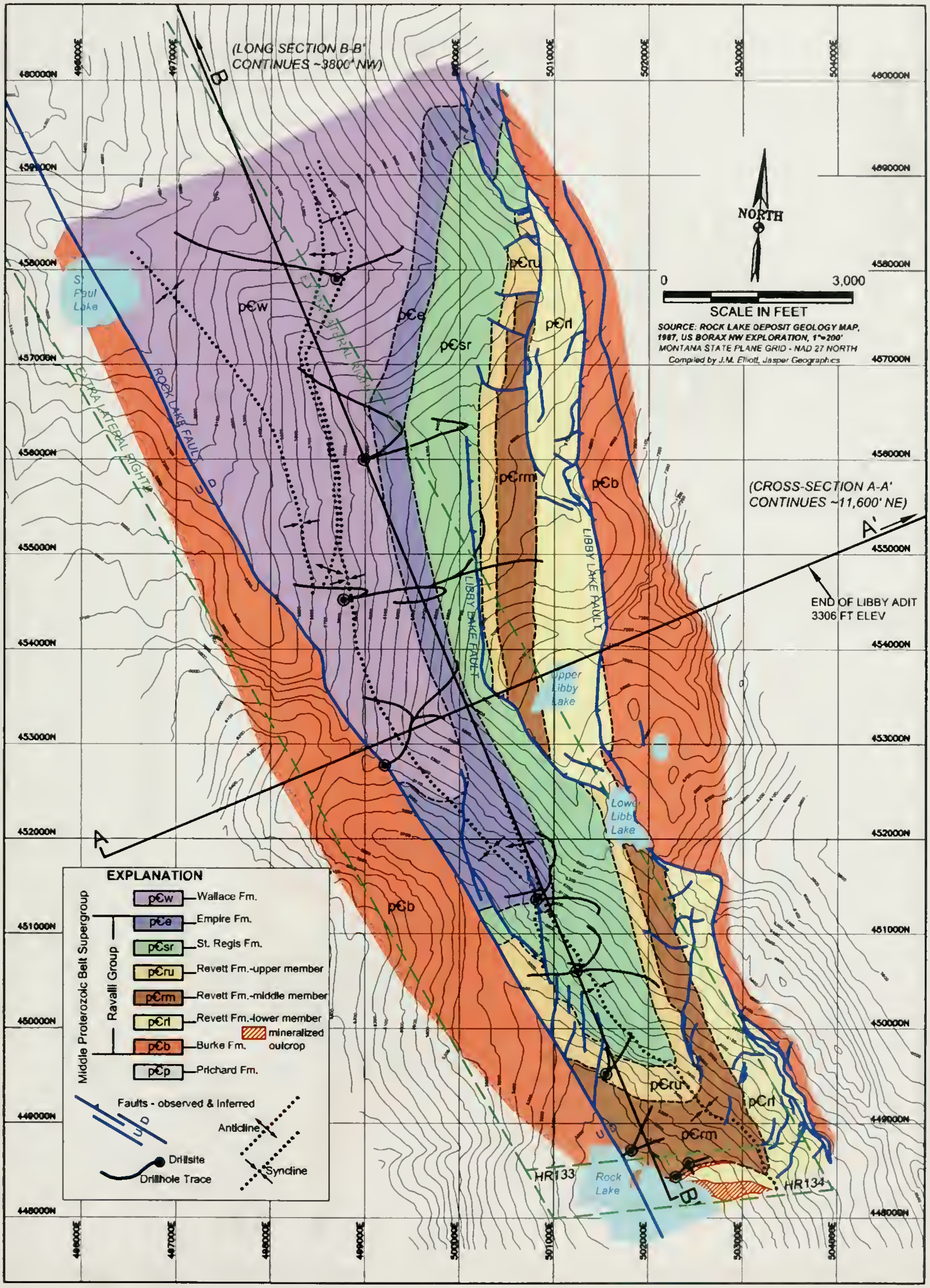


Figure 57. Bedrock Geology of the Rock Creek-Montanore Deposit

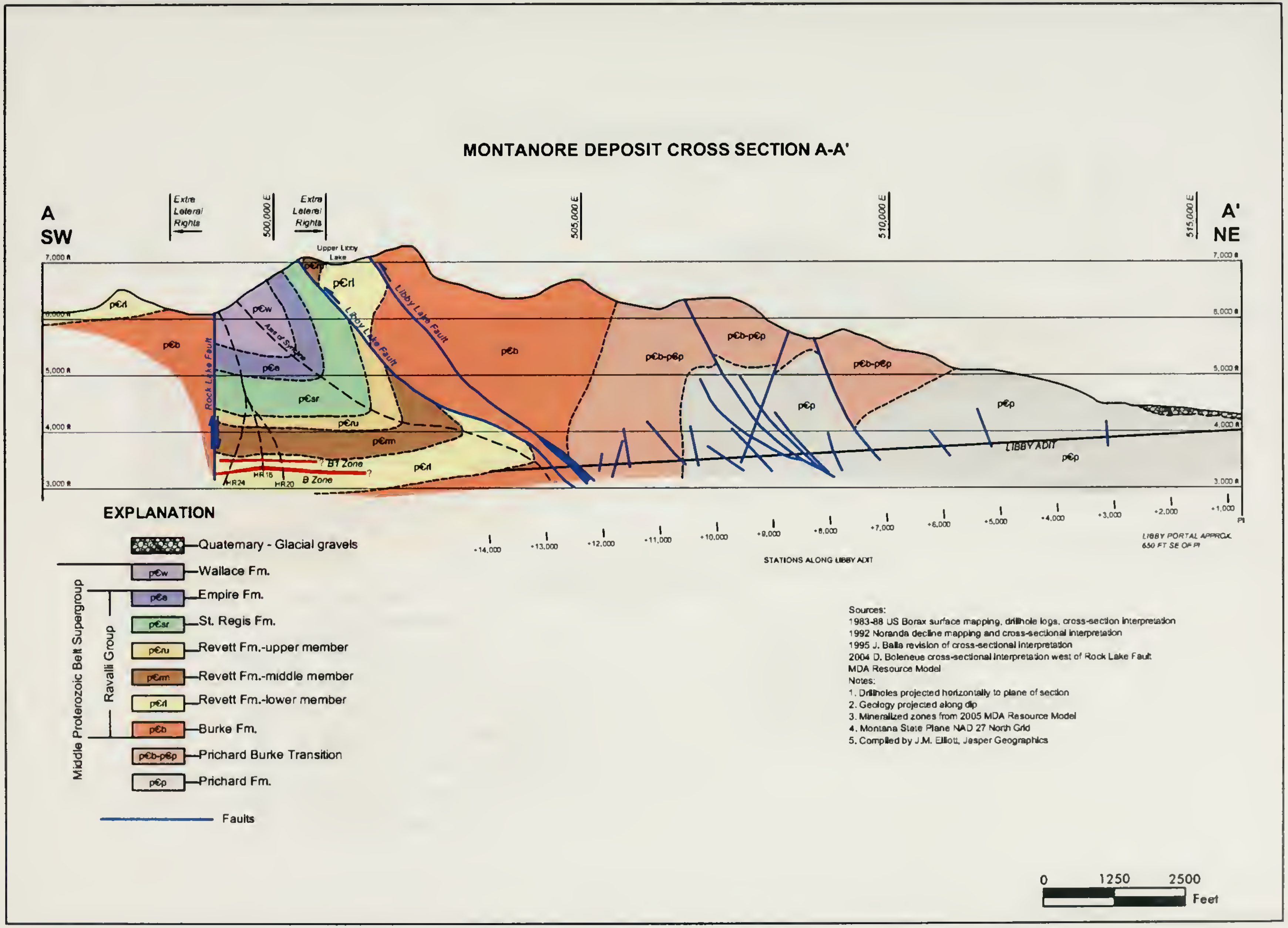


Figure 58. Geologic Cross Section-Libby Adit

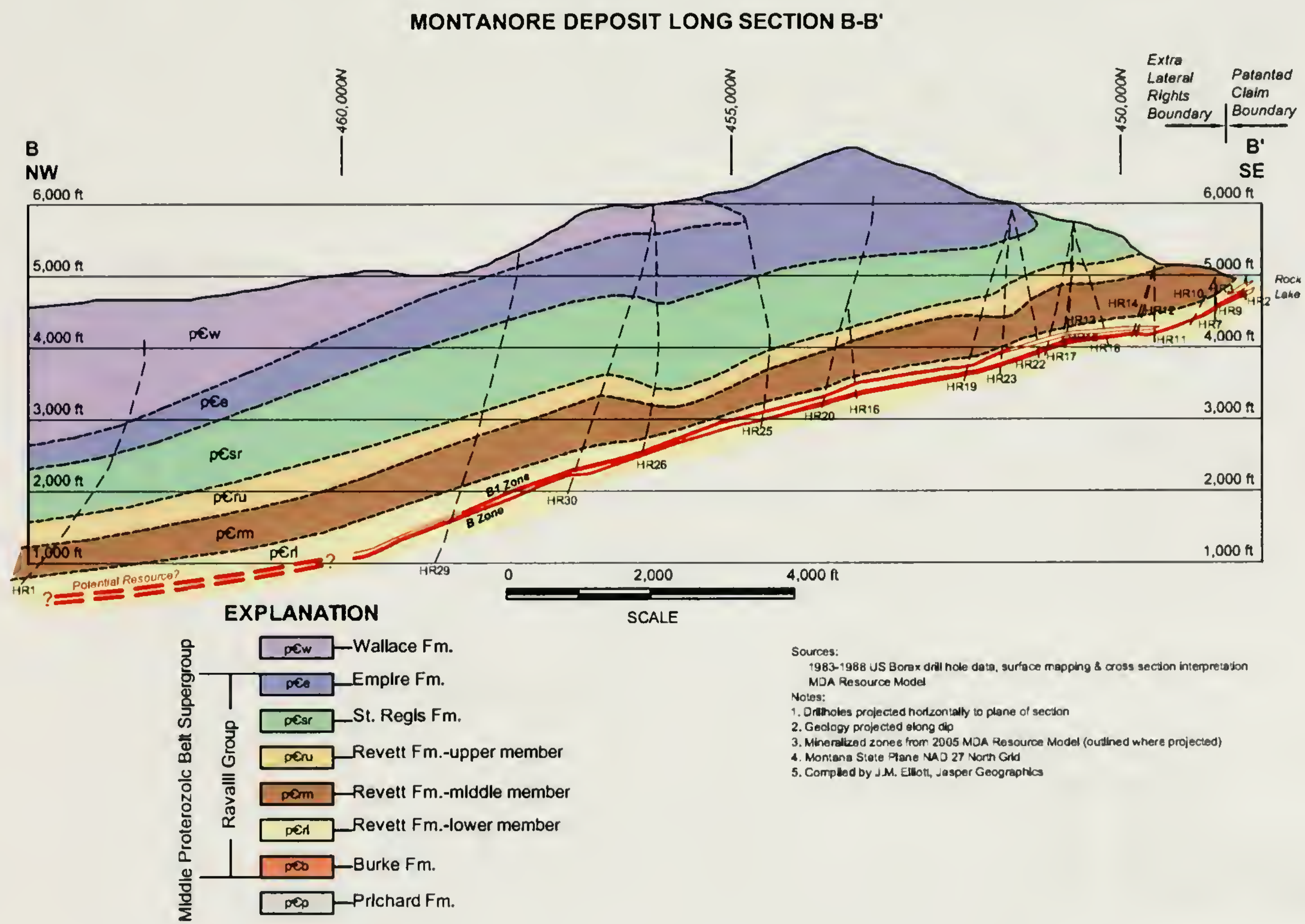


Figure 59. Geologic Cross Section-Montanore Sub-deposit

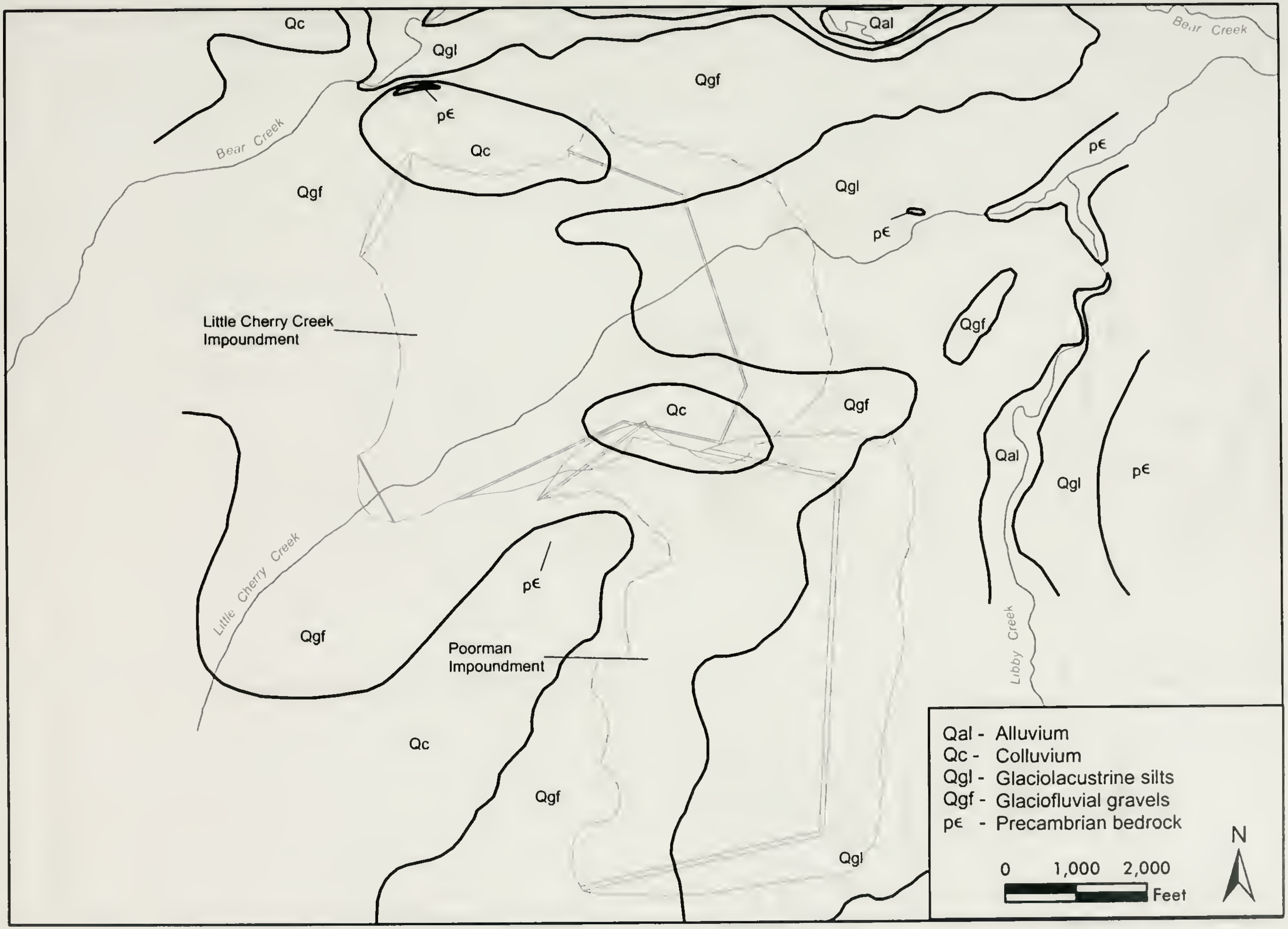


Figure 60. Geology of the Two Tailings Impoundment Areas

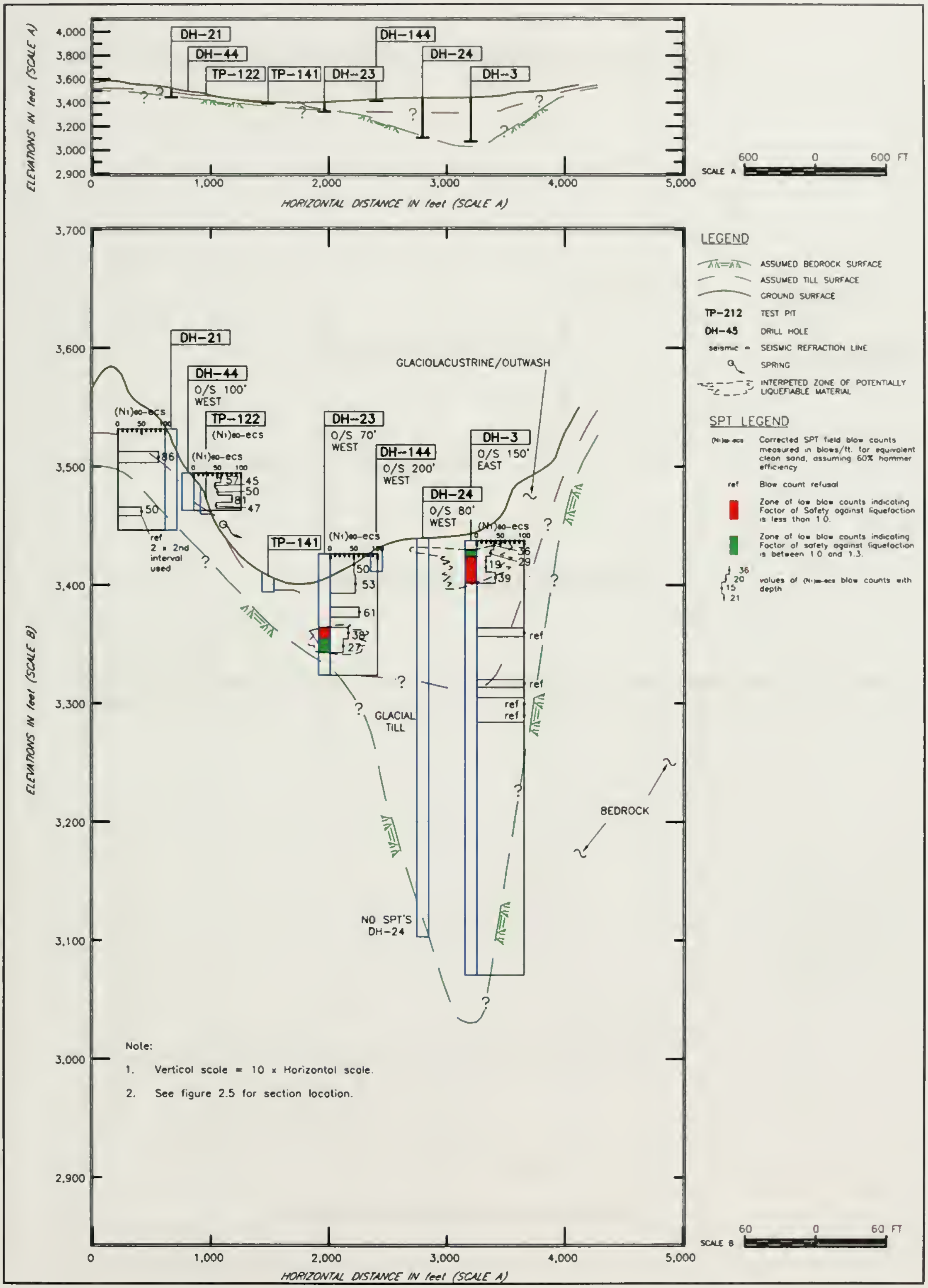
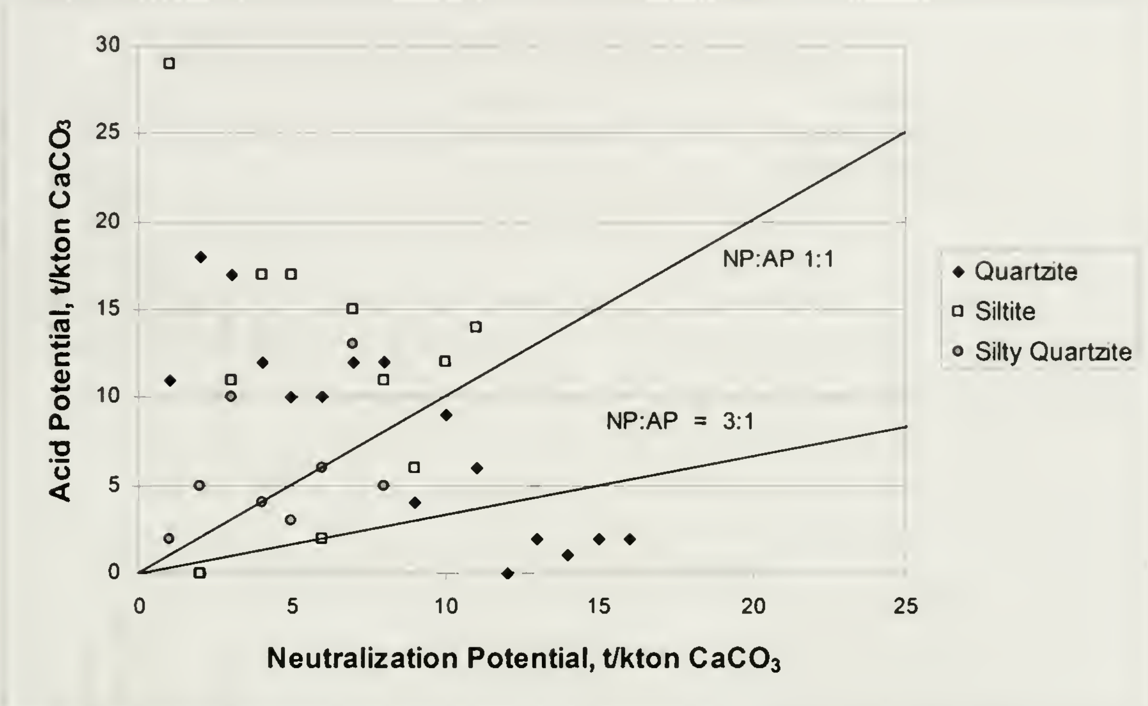


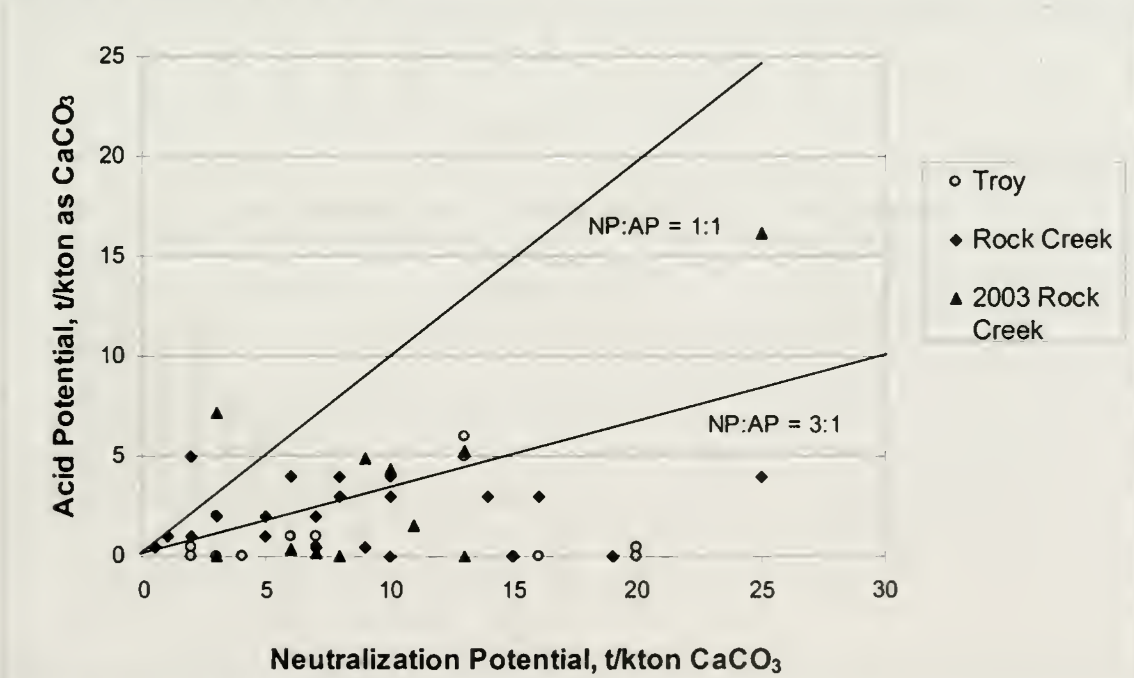
Figure 61. Geologic Cross Section of the Little Cherry Creek Tailings Impoundment Site

Figure 62. Acid Generation Potential of the Montanore Sub-Deposit Ore.



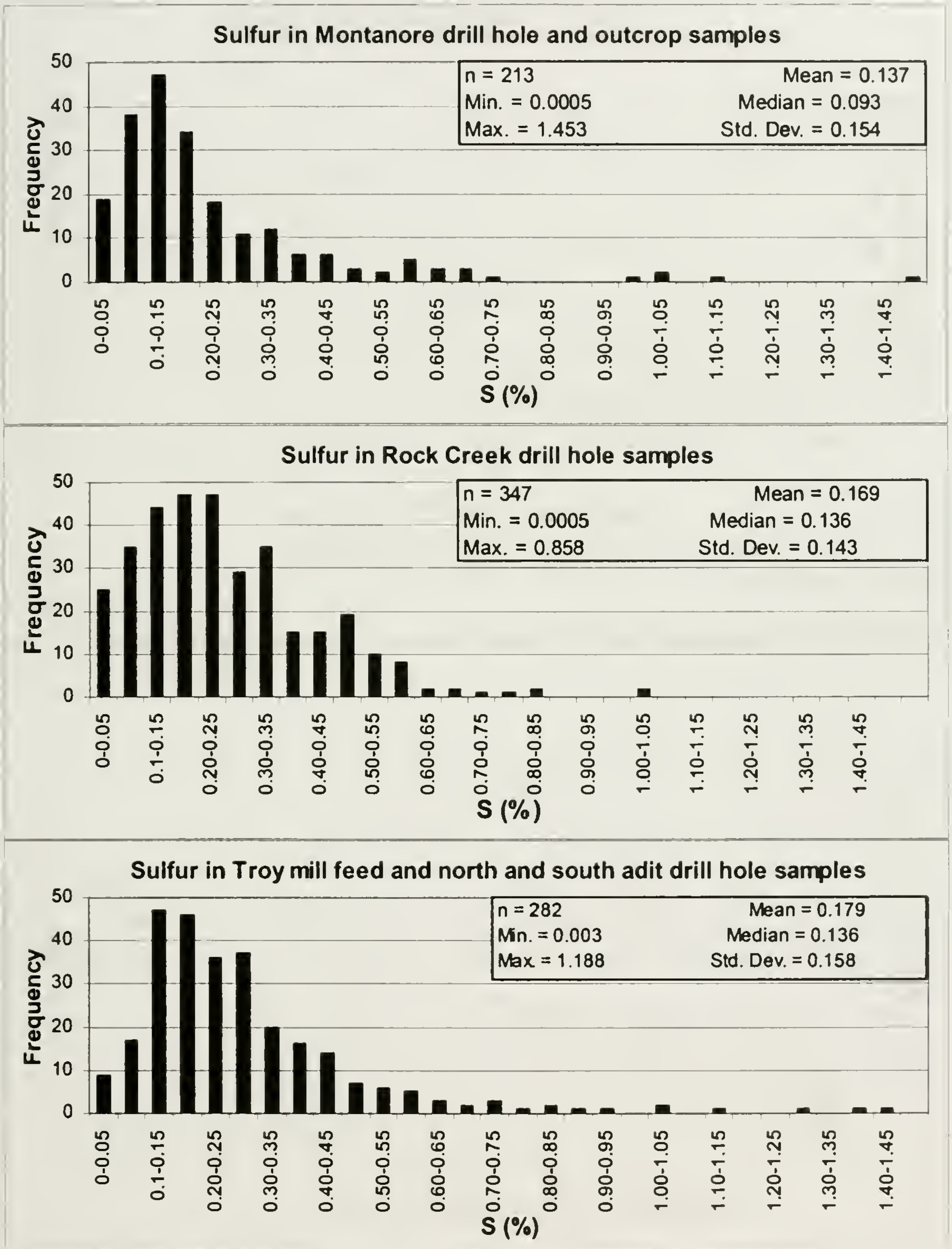
Source: Enviromin 2007

Figure 63. Acid Generation Potential of Ore, from the Rock Creek Sub-deposit and Troy Deposit.



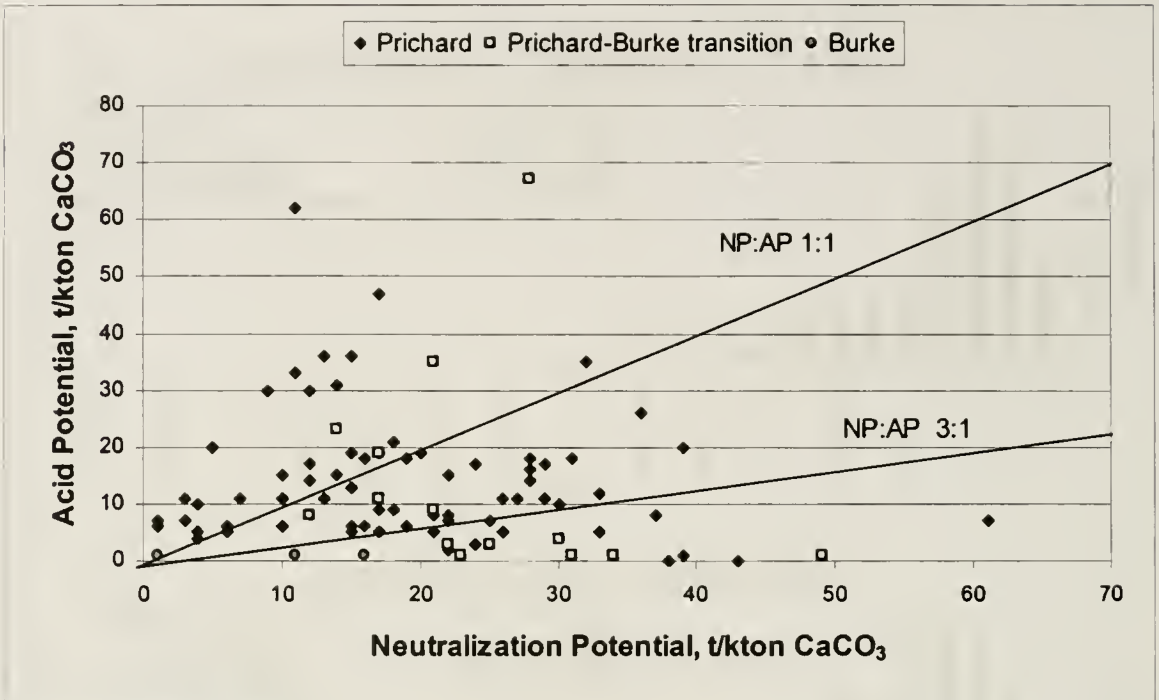
Source: Enviromin 2007

Figure 64. Distribution of Sulfide Calculated Based on Copper Assays for Montanore, Rock Creek, and Troy Deposits.



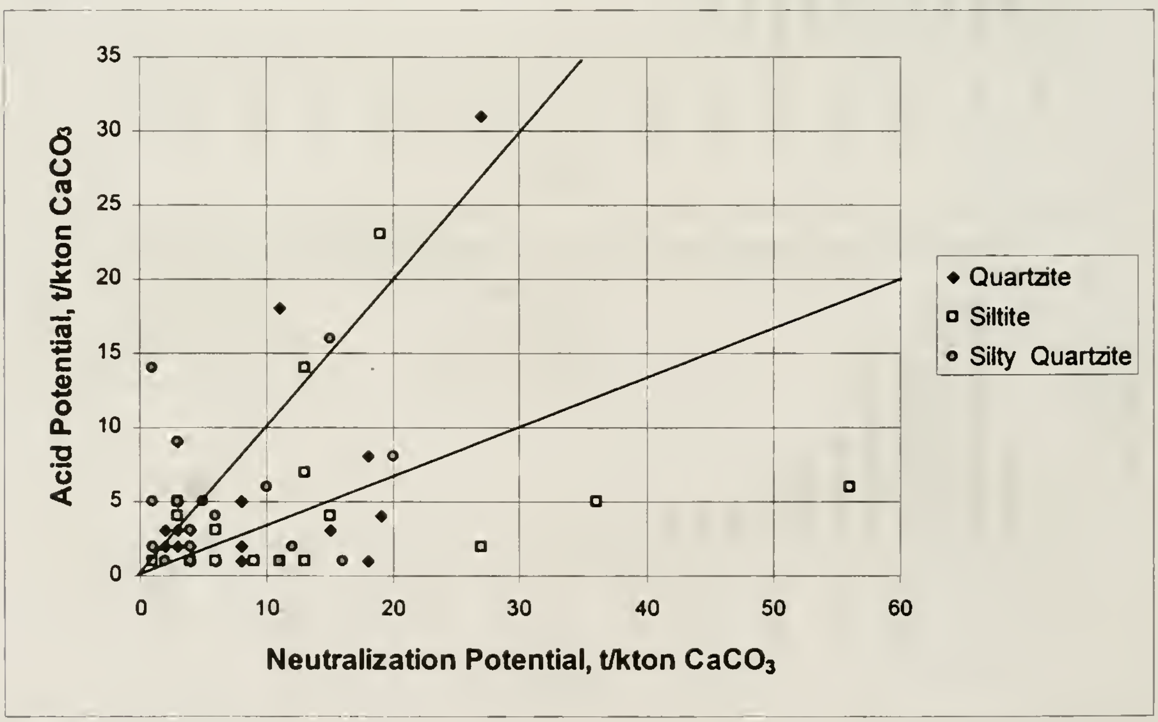
Source: Enviromin 2007

Figure 65. Acid Generation Potential of Waste Rock, Libby Adit, Montanore.



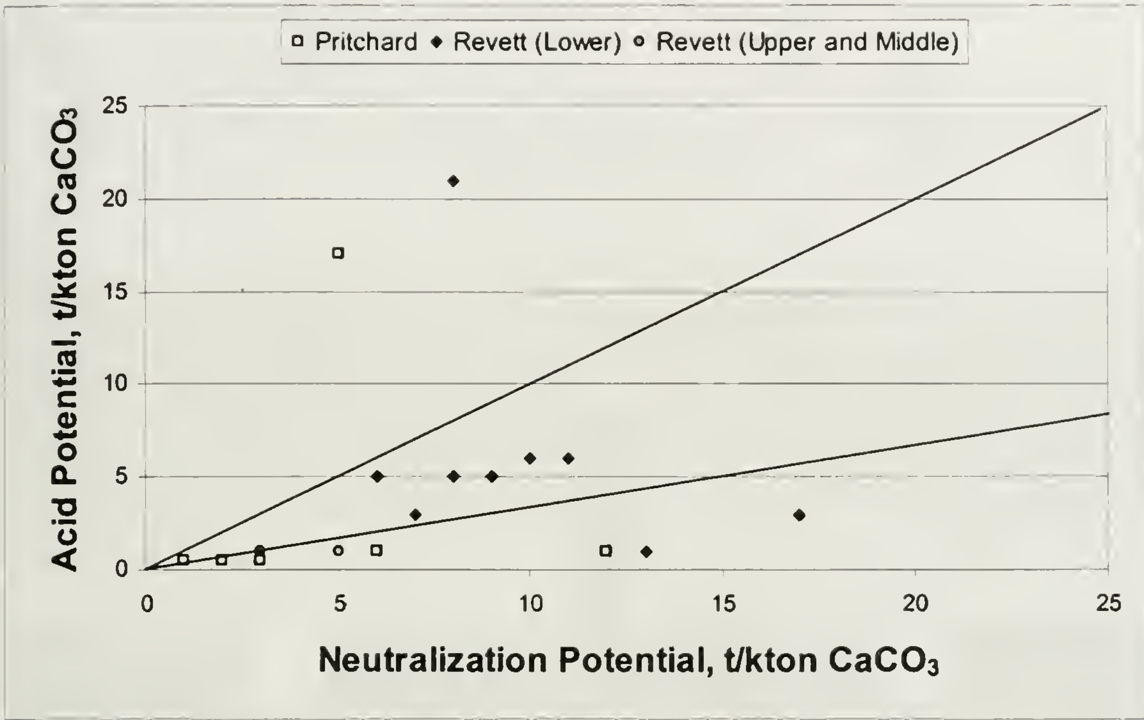
Source: Enviromin 2007.

Figure 66. Acid Generation Potential of Rock Creek and Troy Revett Waste Rock.



Source: Enviromin 2007.

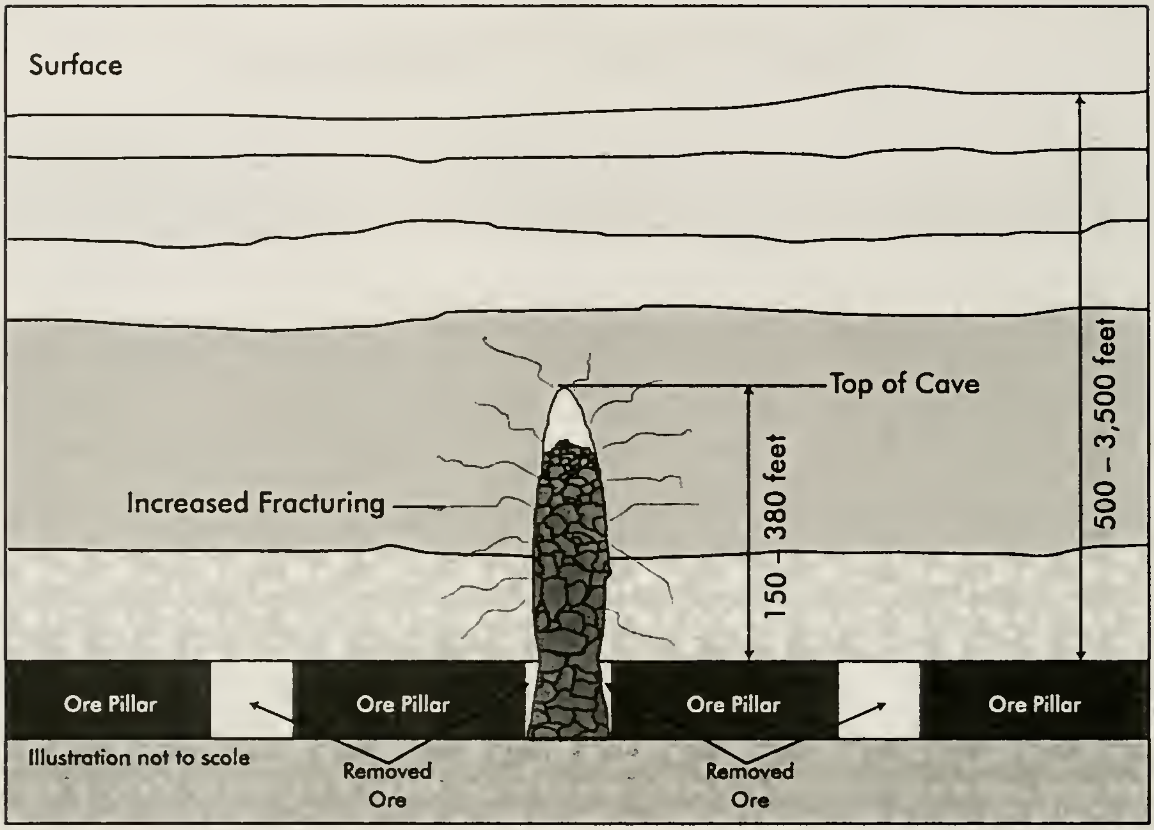
Figure 67. Acid Generation Potential of Rock Creek and Troy Waste Rock Samples by Formation.



Source: Enviromin 2007

Note: sulfide adjusted to account for acid consuming copper sulfide minerals.

Figure 68. Typical Cross Sectional View of Chimney Subsidence.



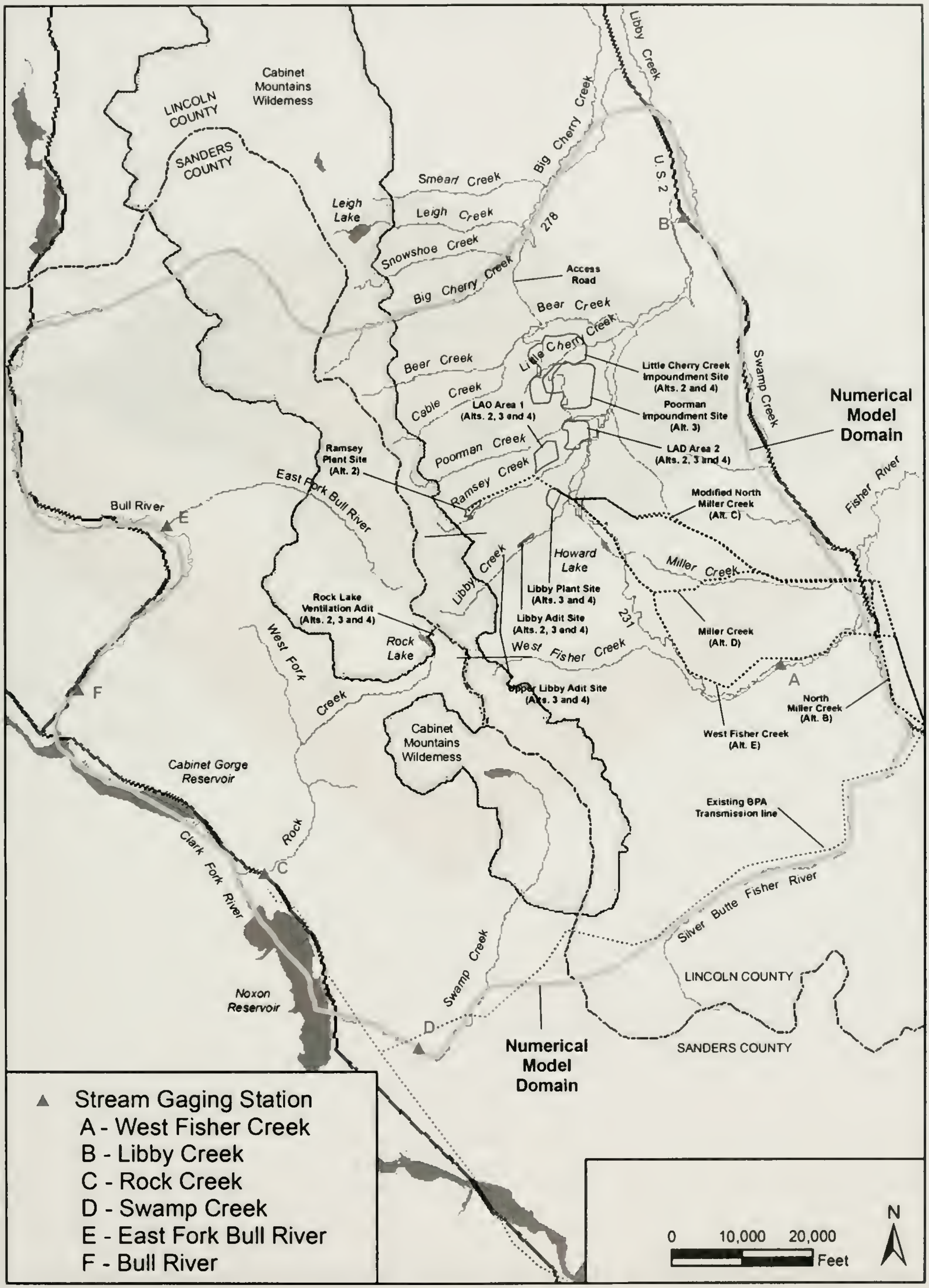


Figure 69. Numerical Model Domain and Project Area Location

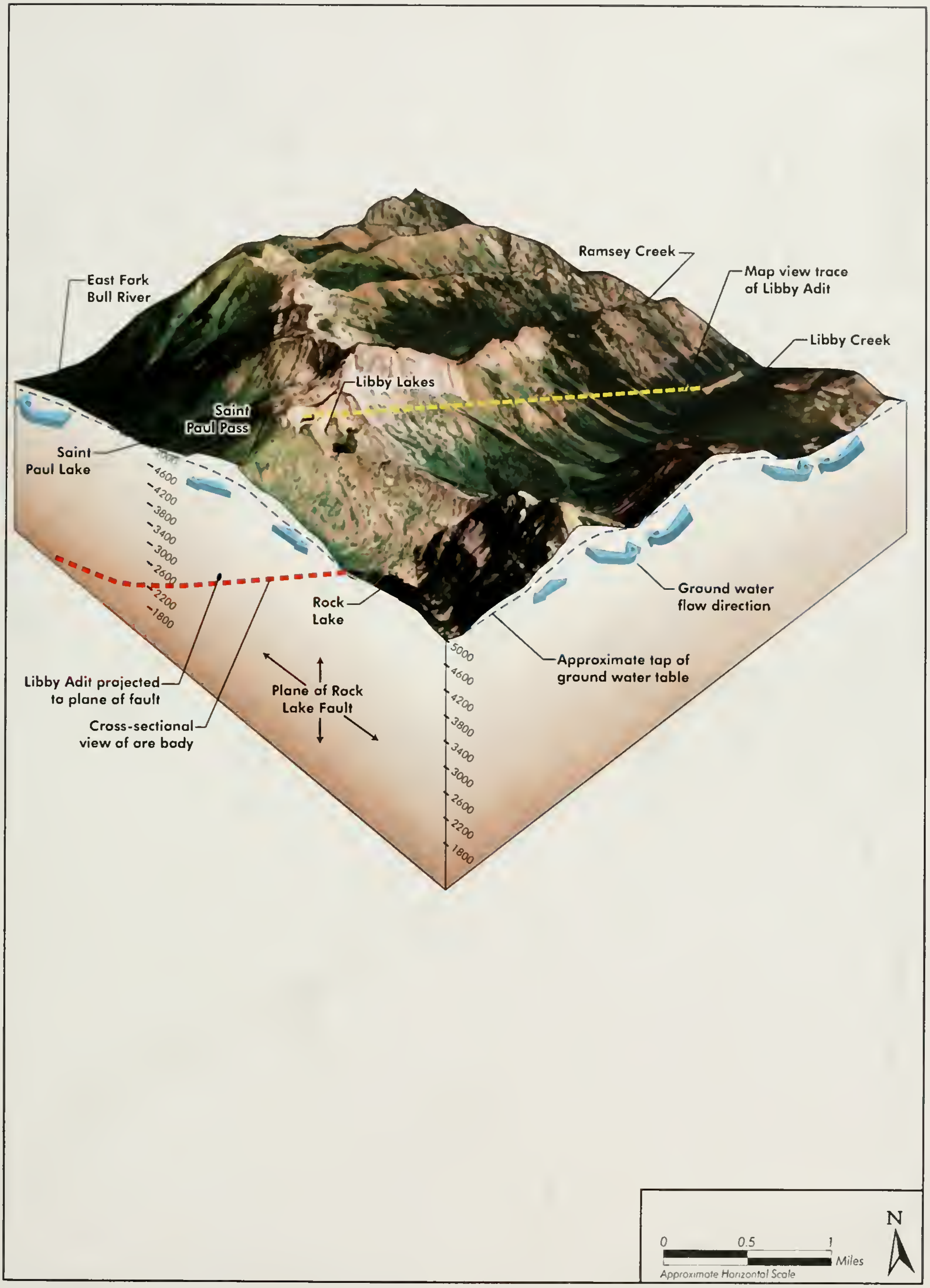


Figure 70. Agencies' Three Dimensional Conceptual Model of the Montanore Mine Area Hydrogeology

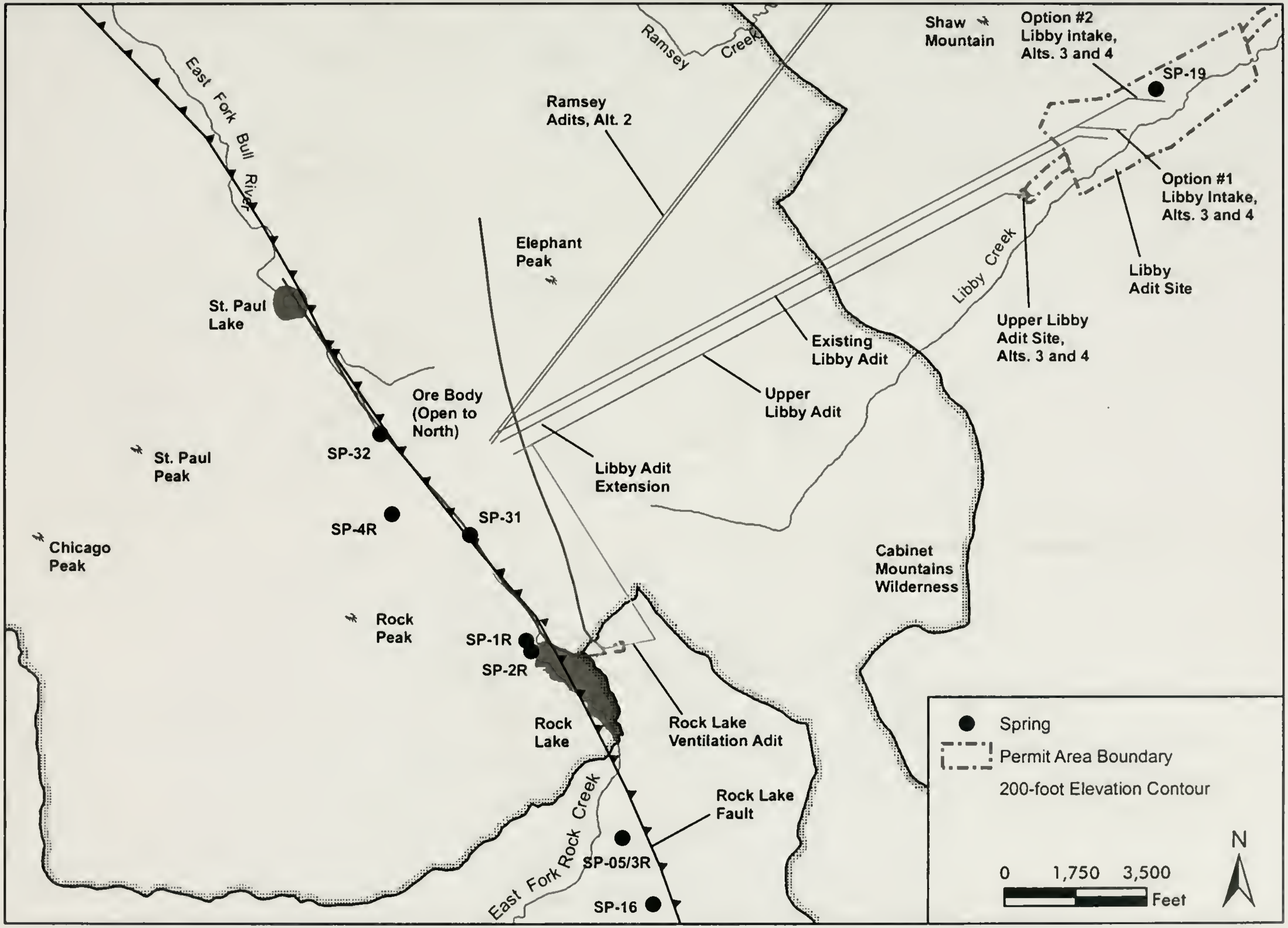


Figure 71. Identified Springs in the Mine Area

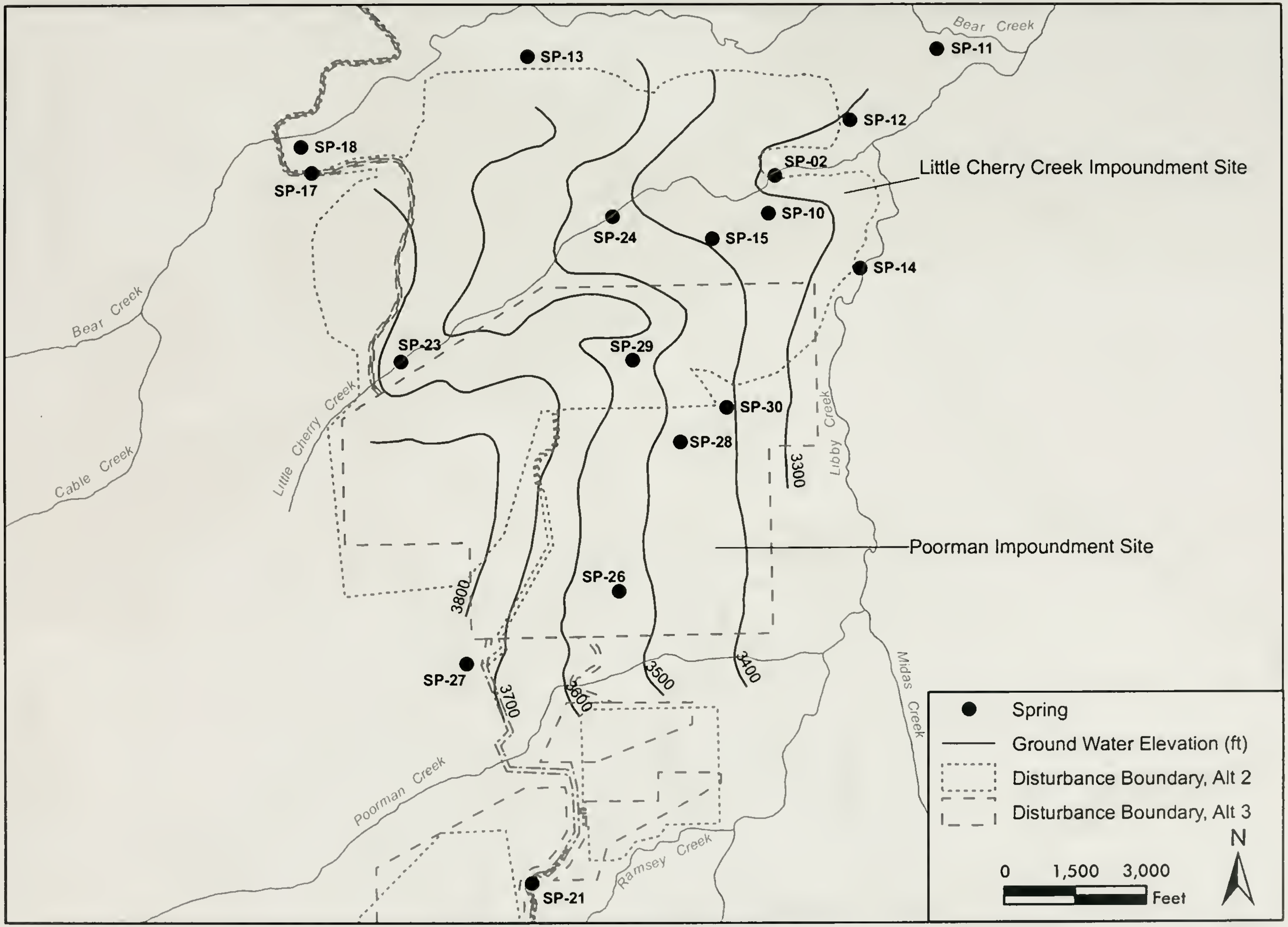


Figure 72. Identified Springs and Ground Water Levels in the Tailings Impoundment Sites

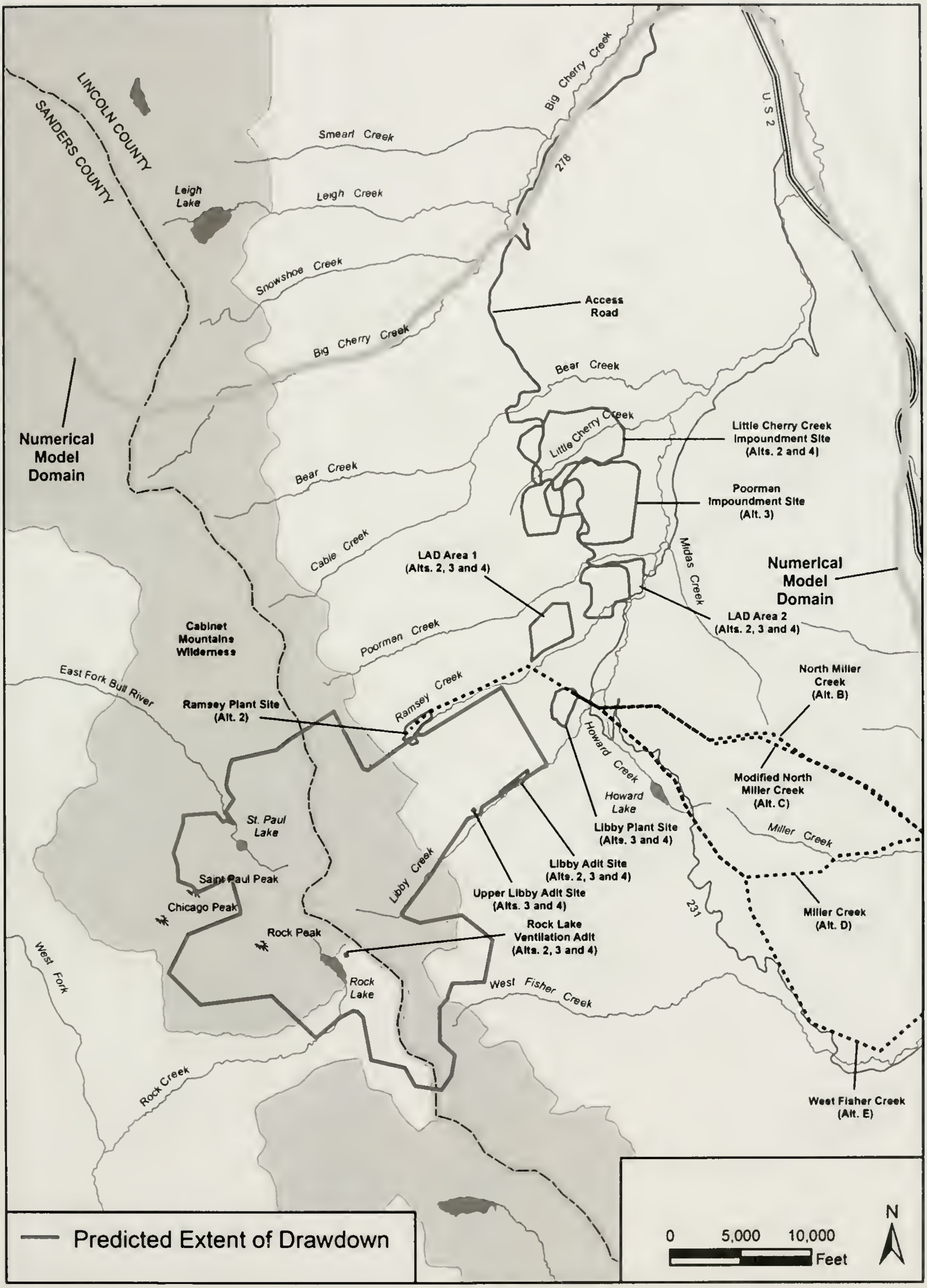


Figure 73. Predicted Area of Ground Water Drawdown During Mining

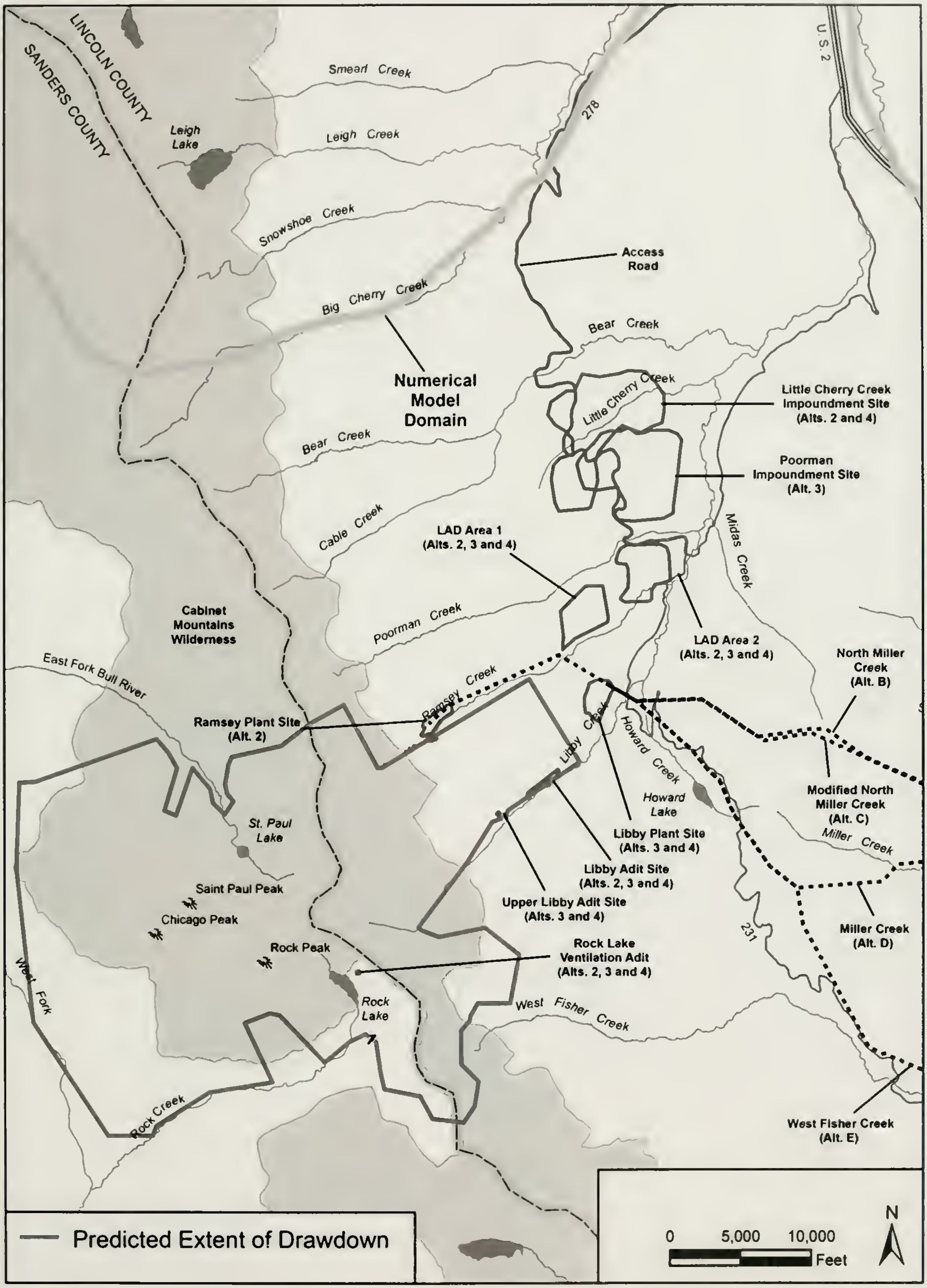


Figure 74. Predicted Area of Cumulative Ground Water Drawdown During Mining

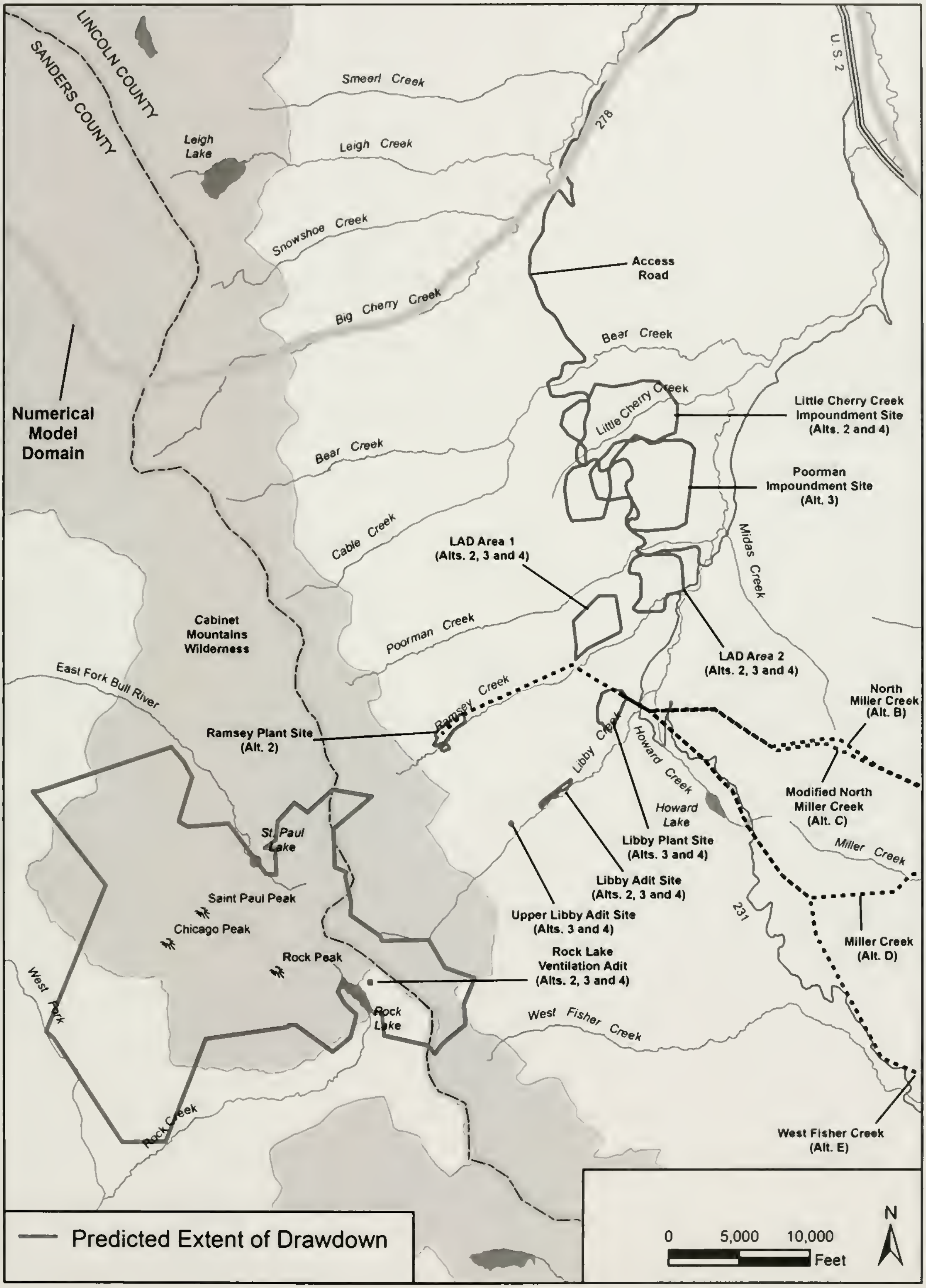


Figure 75. Predicted Area of Cumulative Ground Water Drawdown Post-mining

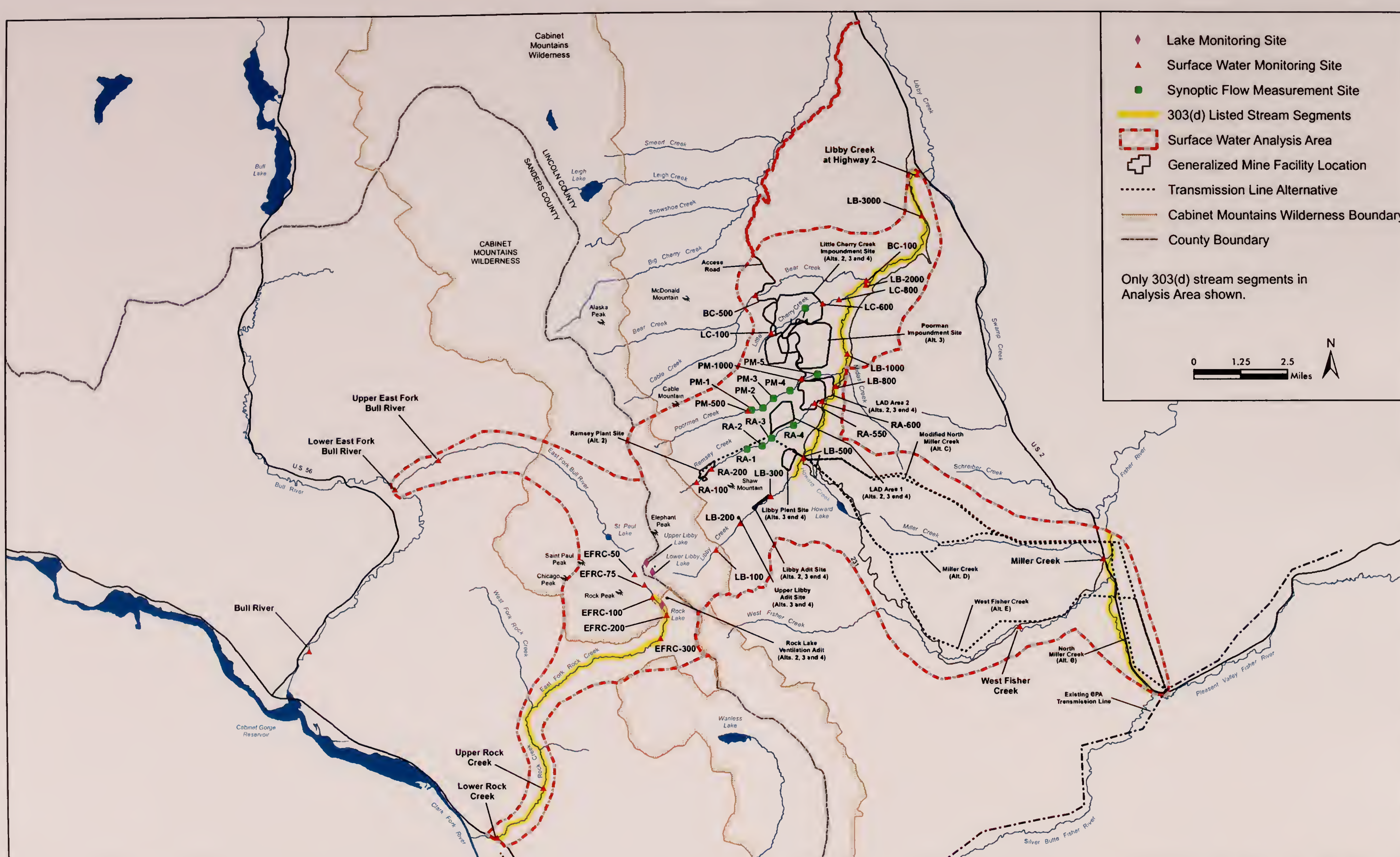


Figure 76. Surface Water Resources in the Analysis Area

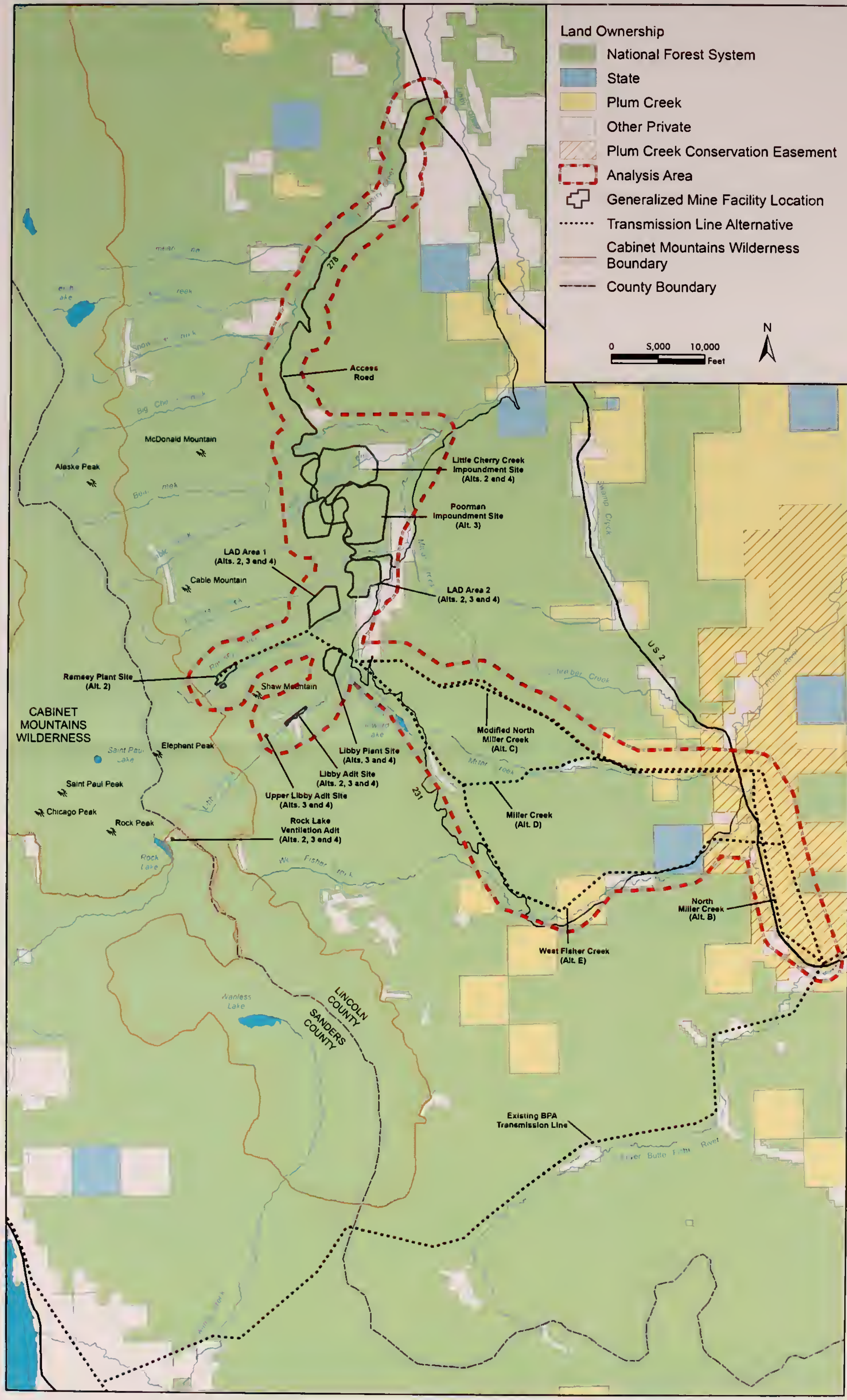


Figure 77. Land Ownership in the Analysis Area

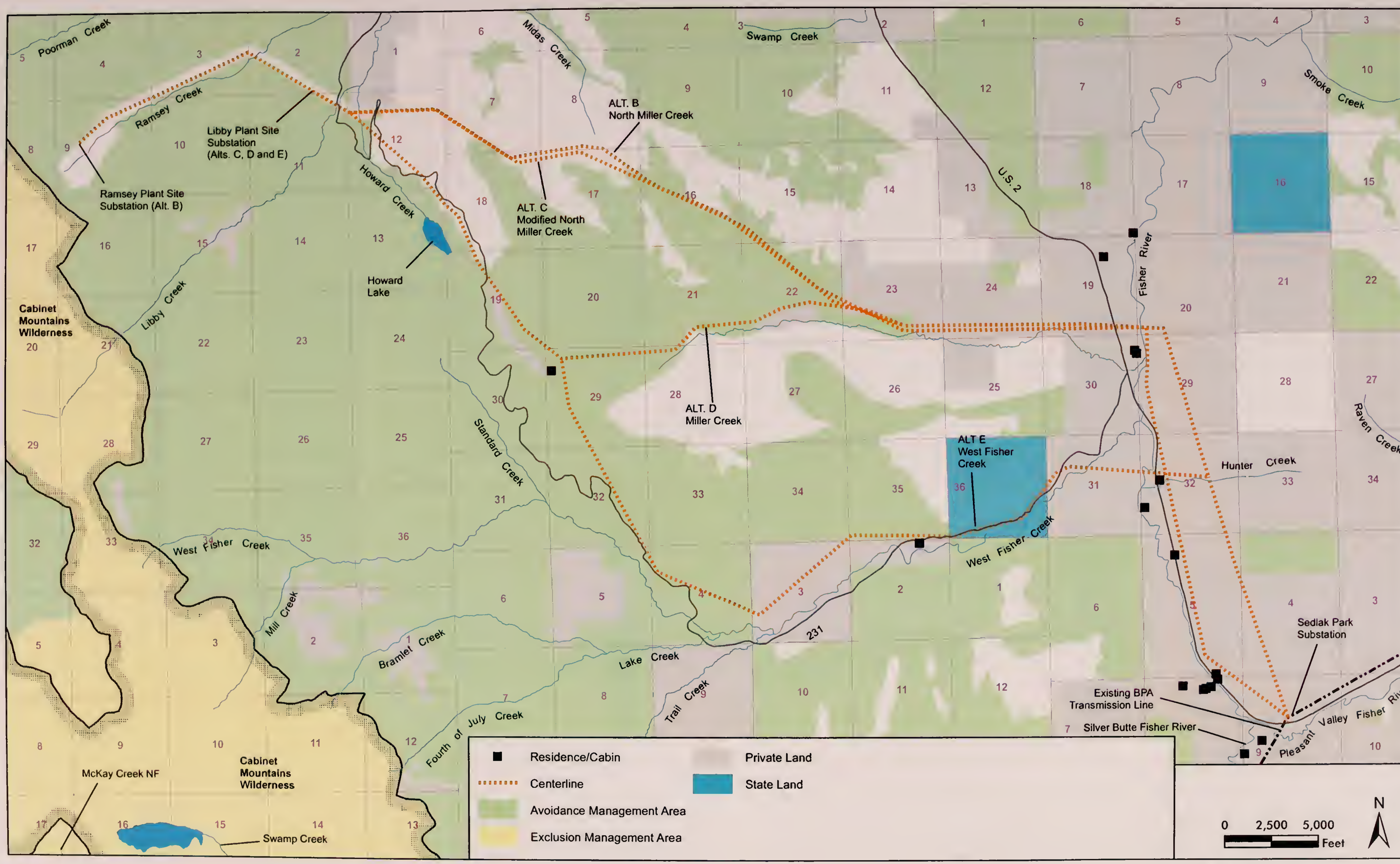


Figure 78. Residences, Corridor Exclusion Management Areas, and Corridor Avoidance Management Areas Along Transmission Line Alternatives

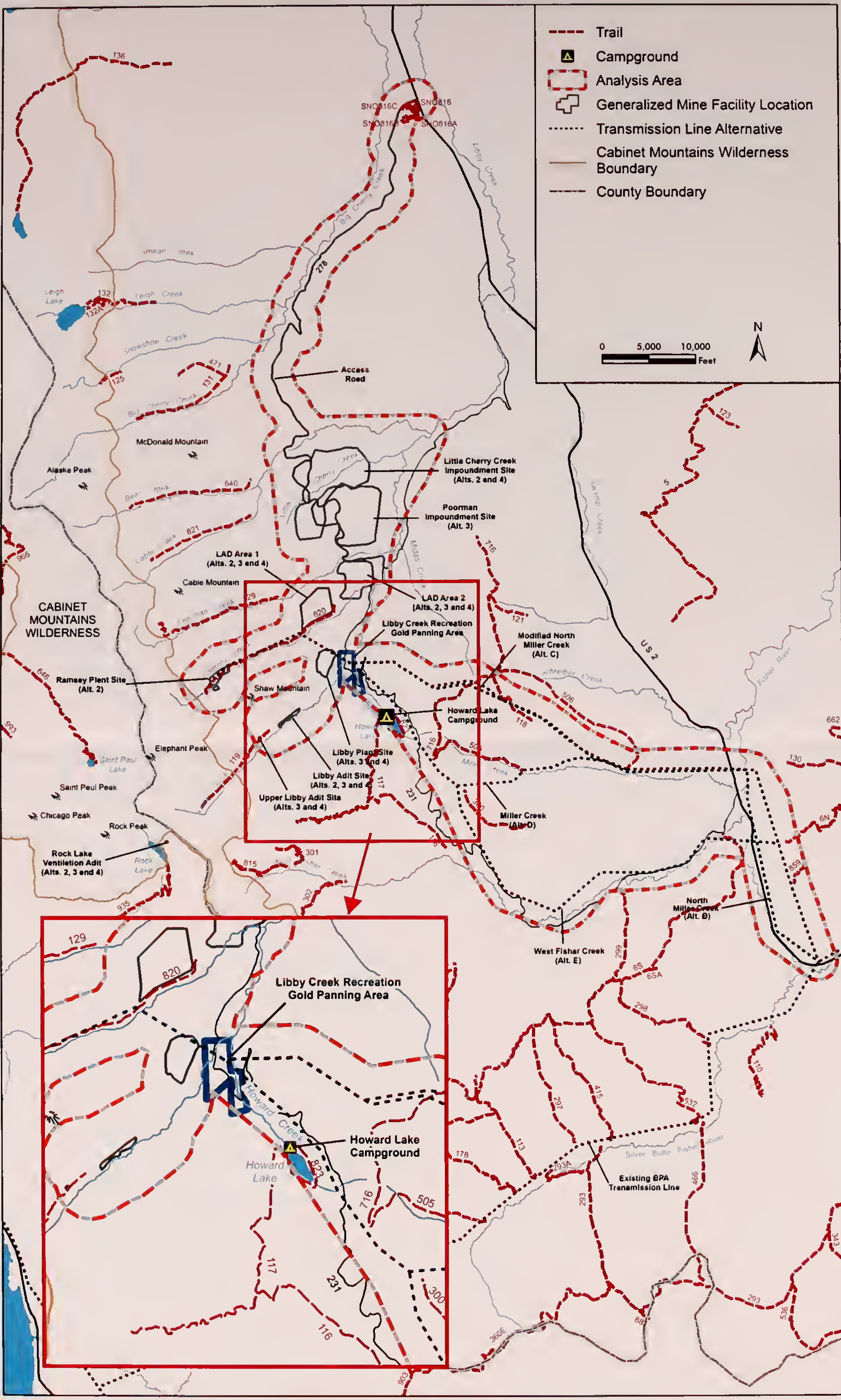


Figure 79. Key Recreation Resources in the Analysis Area

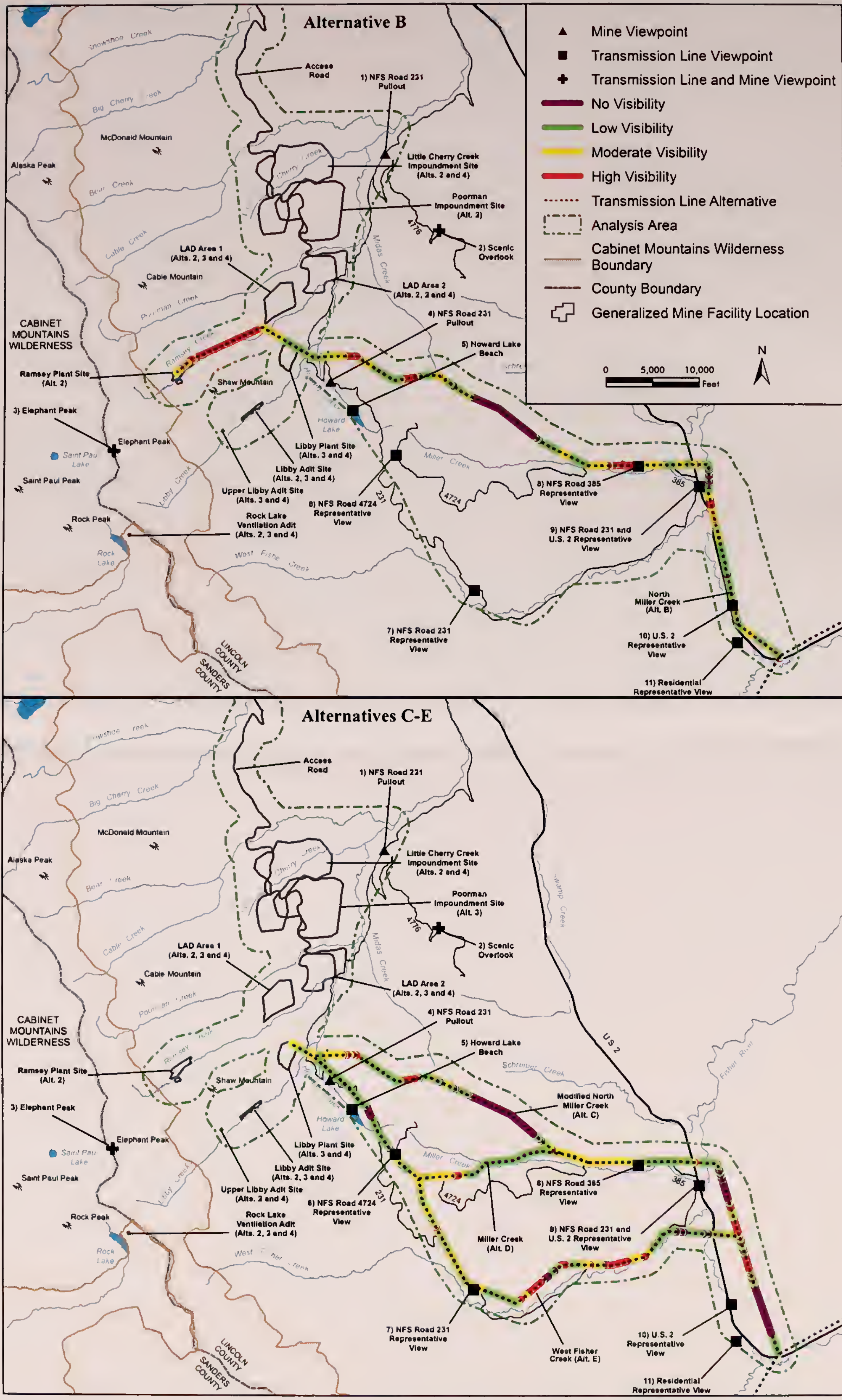


Figure 80. Transmission Line Segments Visible from KOPs, Roads and the CMW

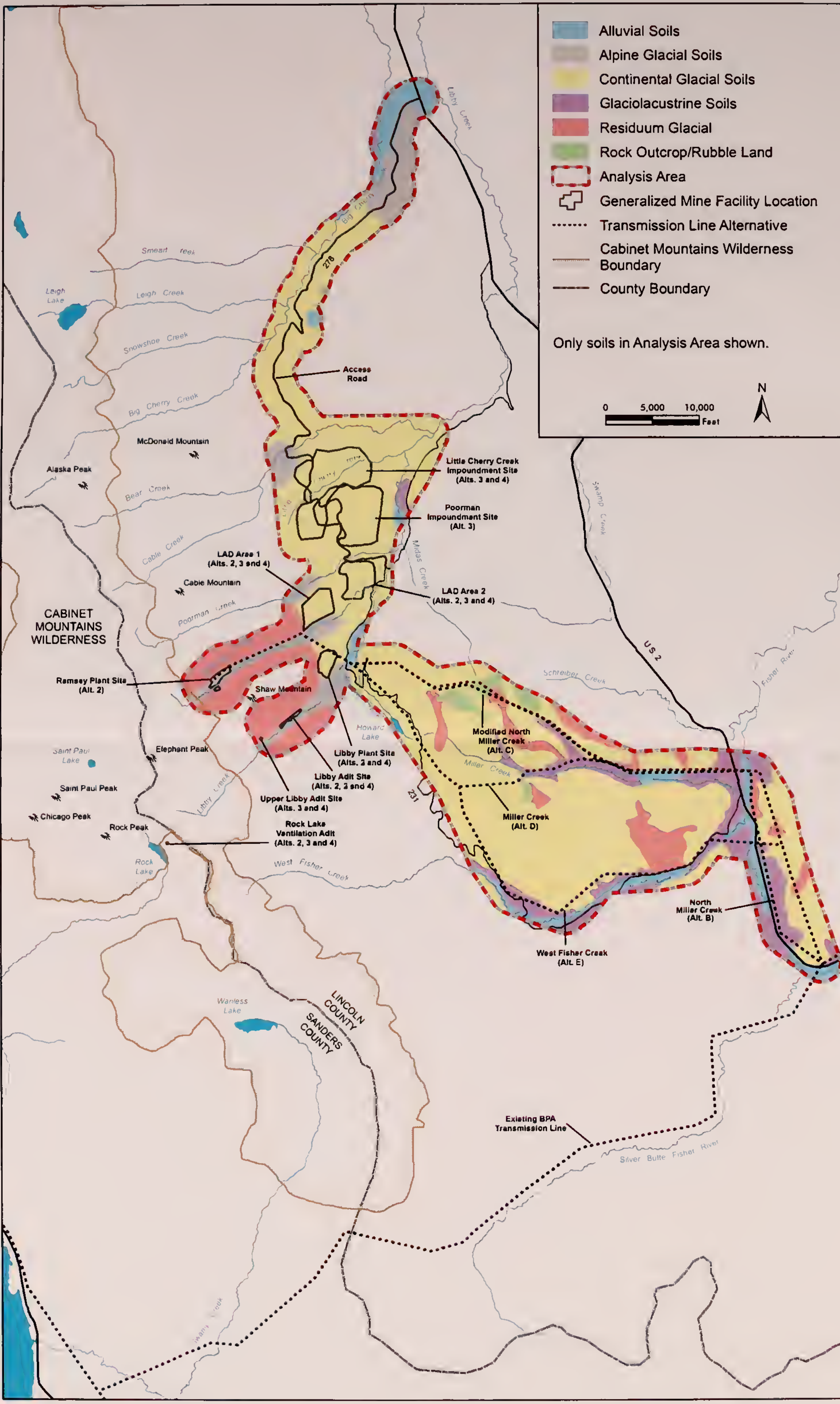


Figure 81. General Soil Types in the Analysis Area

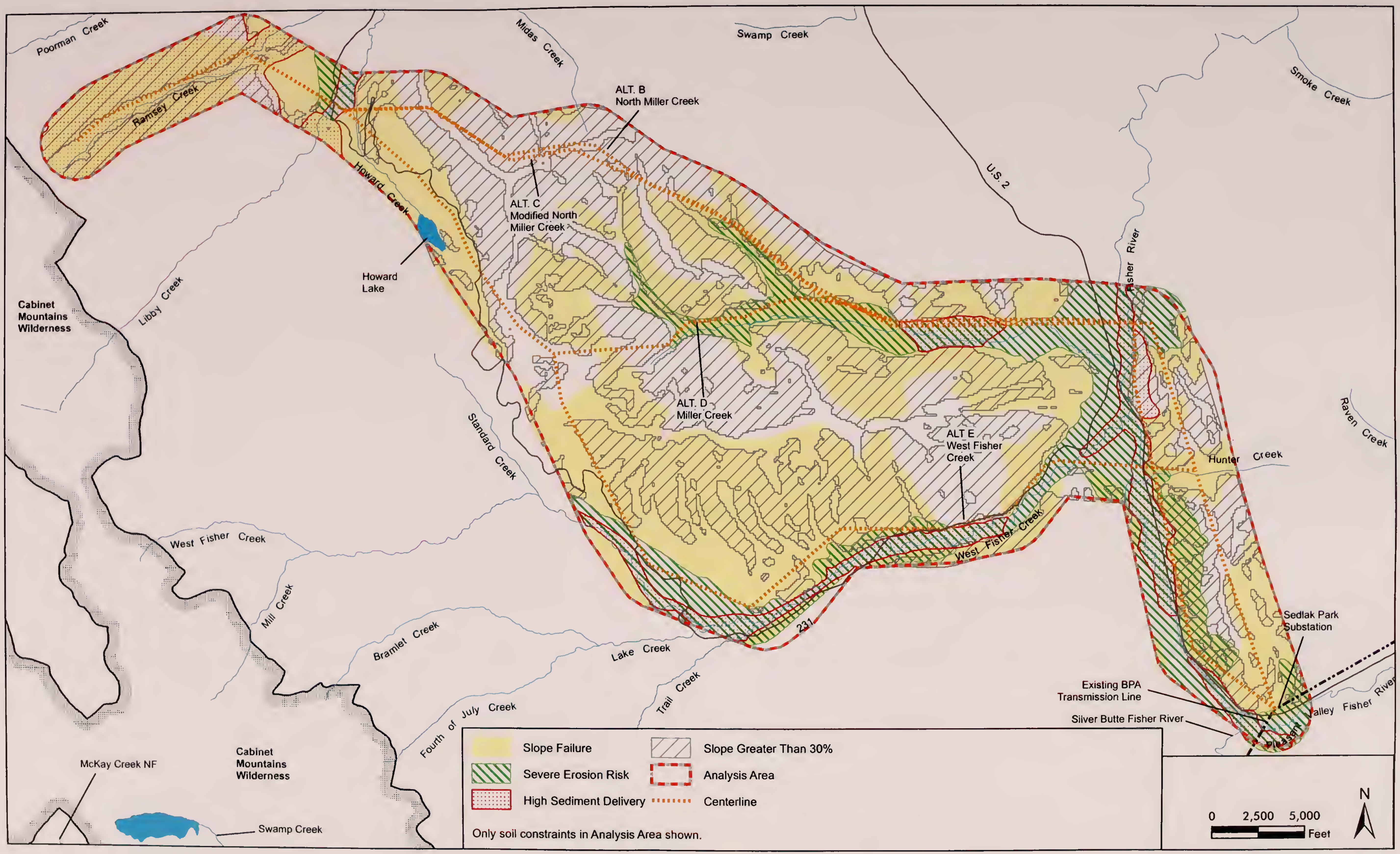


Figure 82. Soil Constraints Along Transmission Line Alternatives

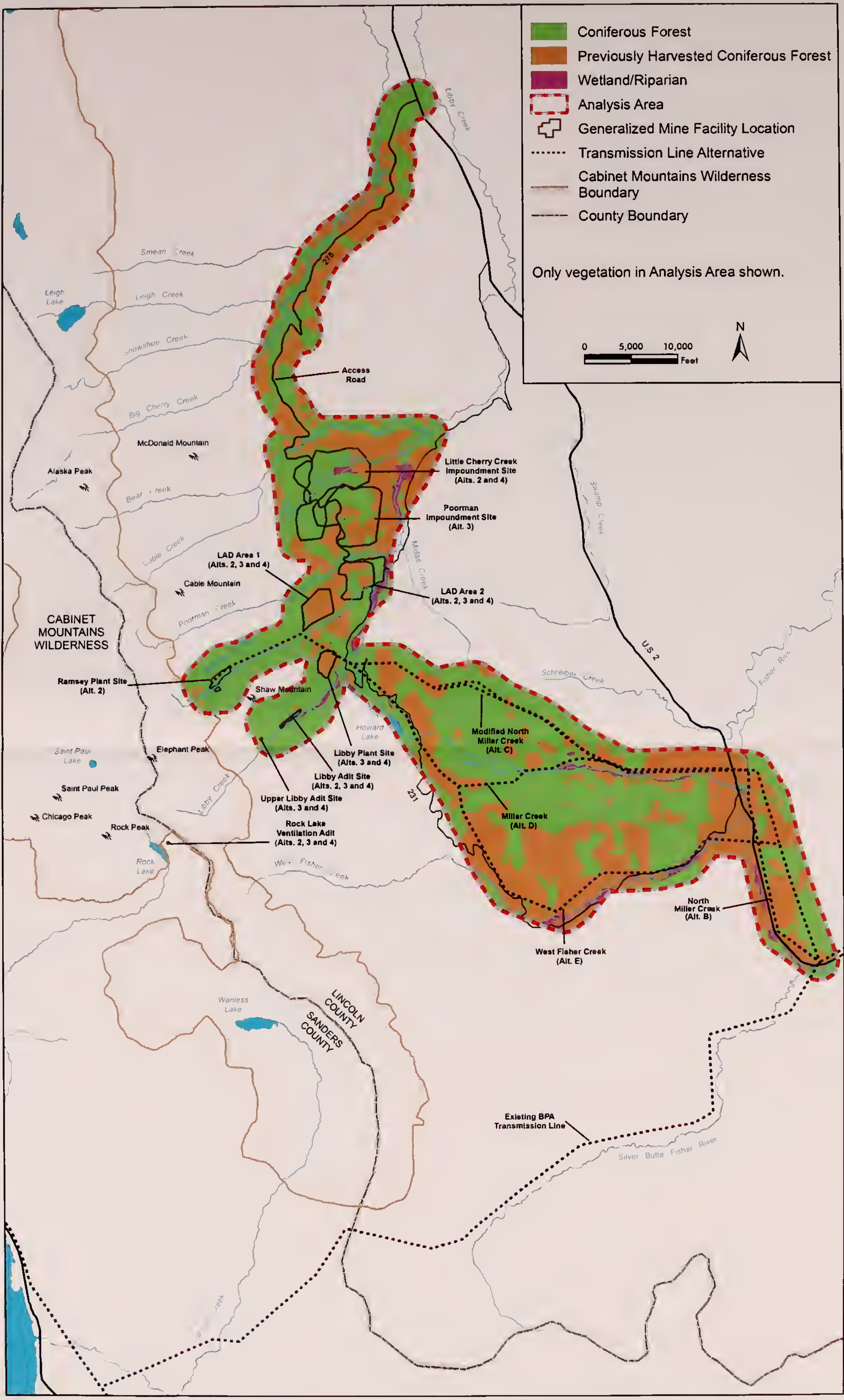


Figure 83. Vegetation Communities in the Analysis Area

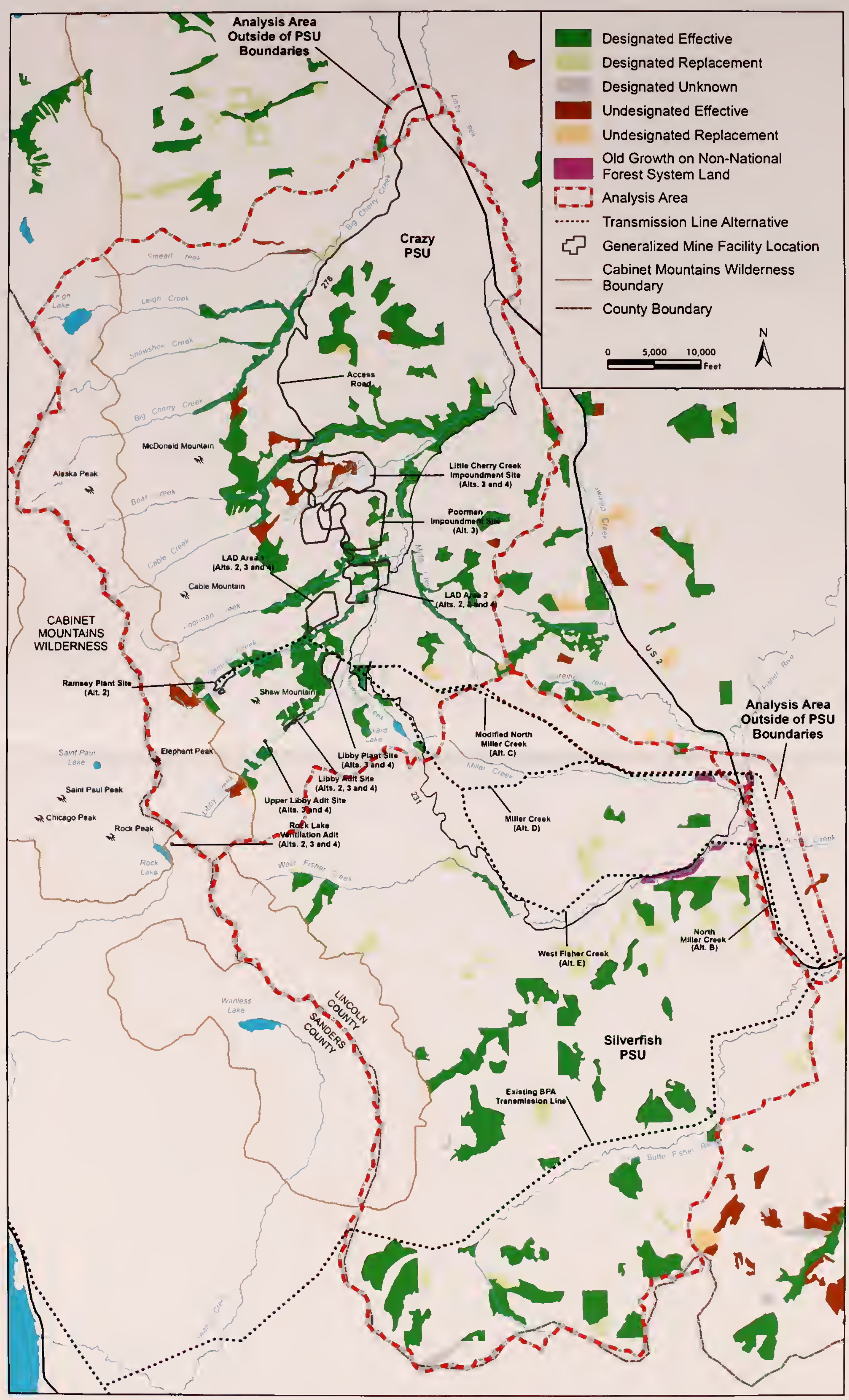


Figure 84. Old Growth Forest in the Analysis Area

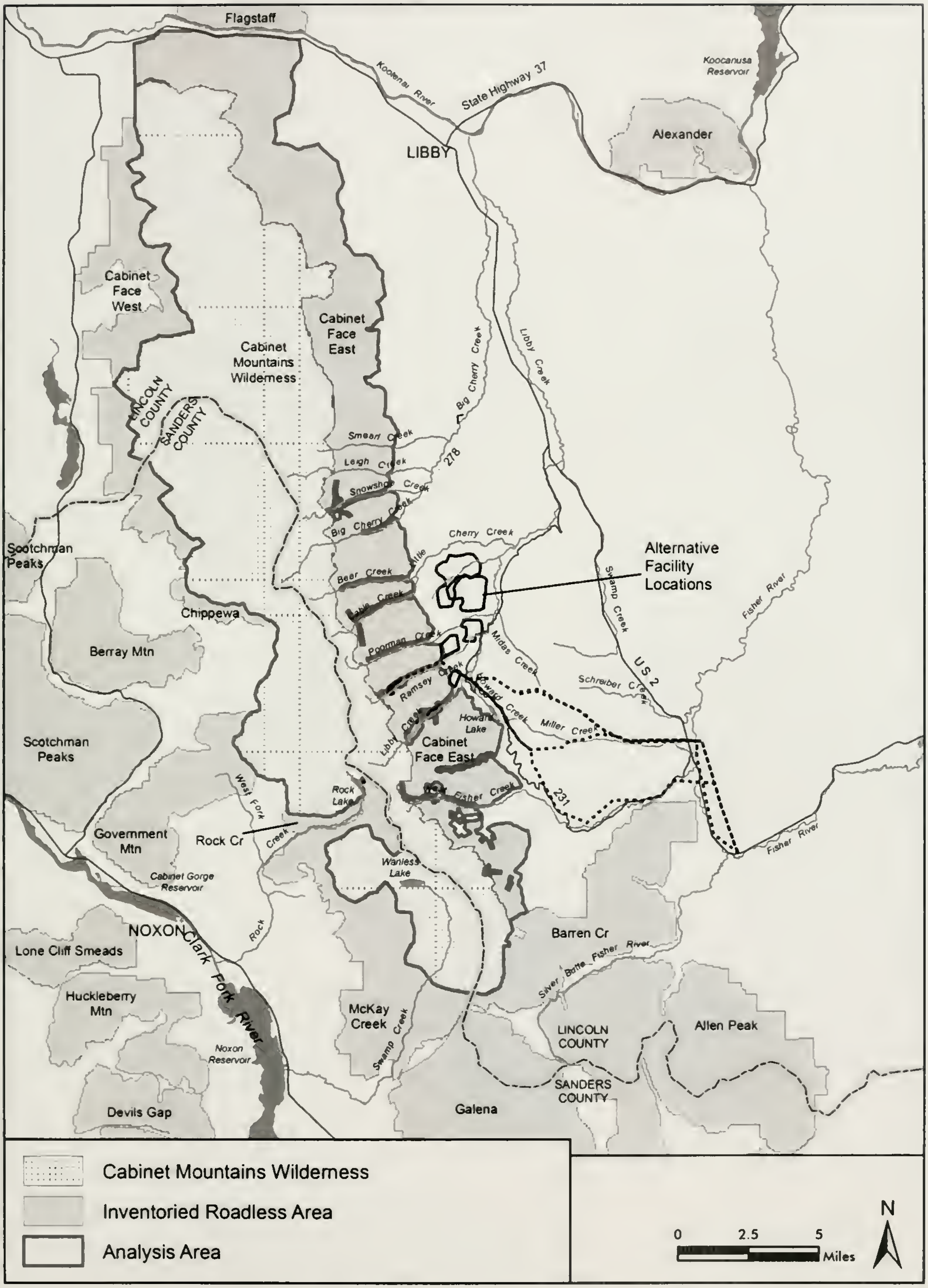


Figure 86. Cabinet Mountains Wilderness and the Cabinet Face East IRA

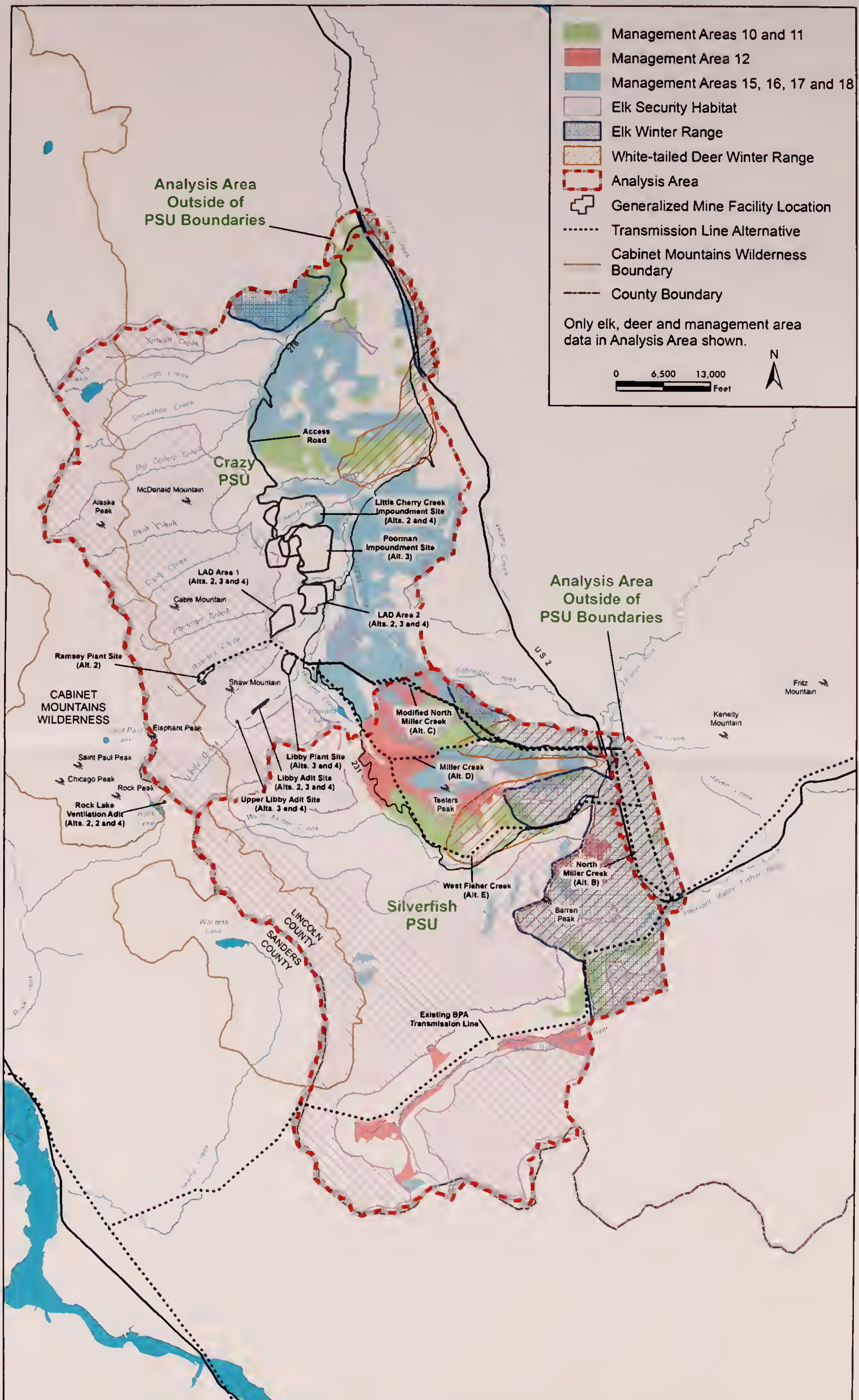


Figure 87. Elk and White-tailed Deer Habitat in the Analysis Area

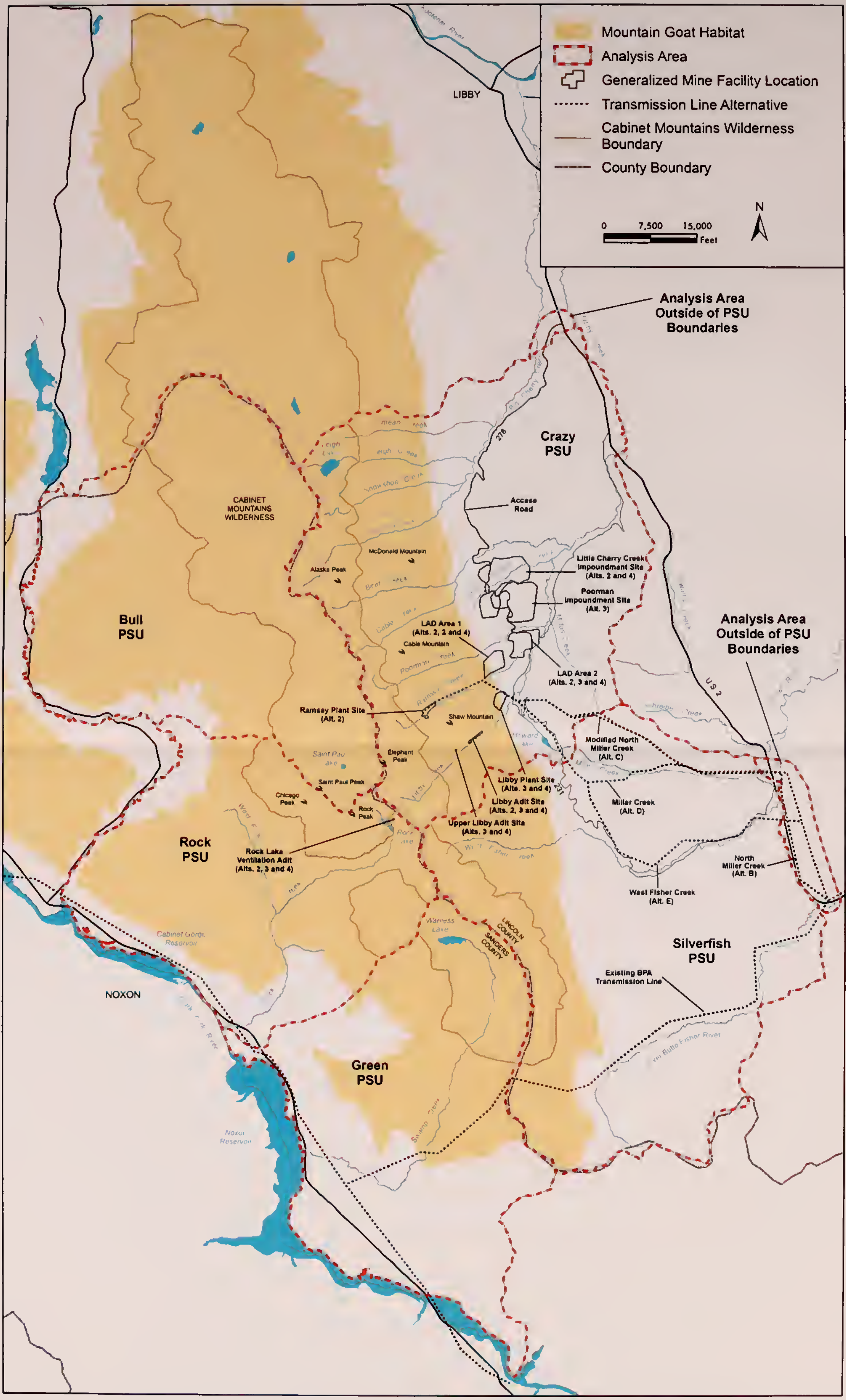


Figure 88. Mountain Goat Habitat in the Analysis Area

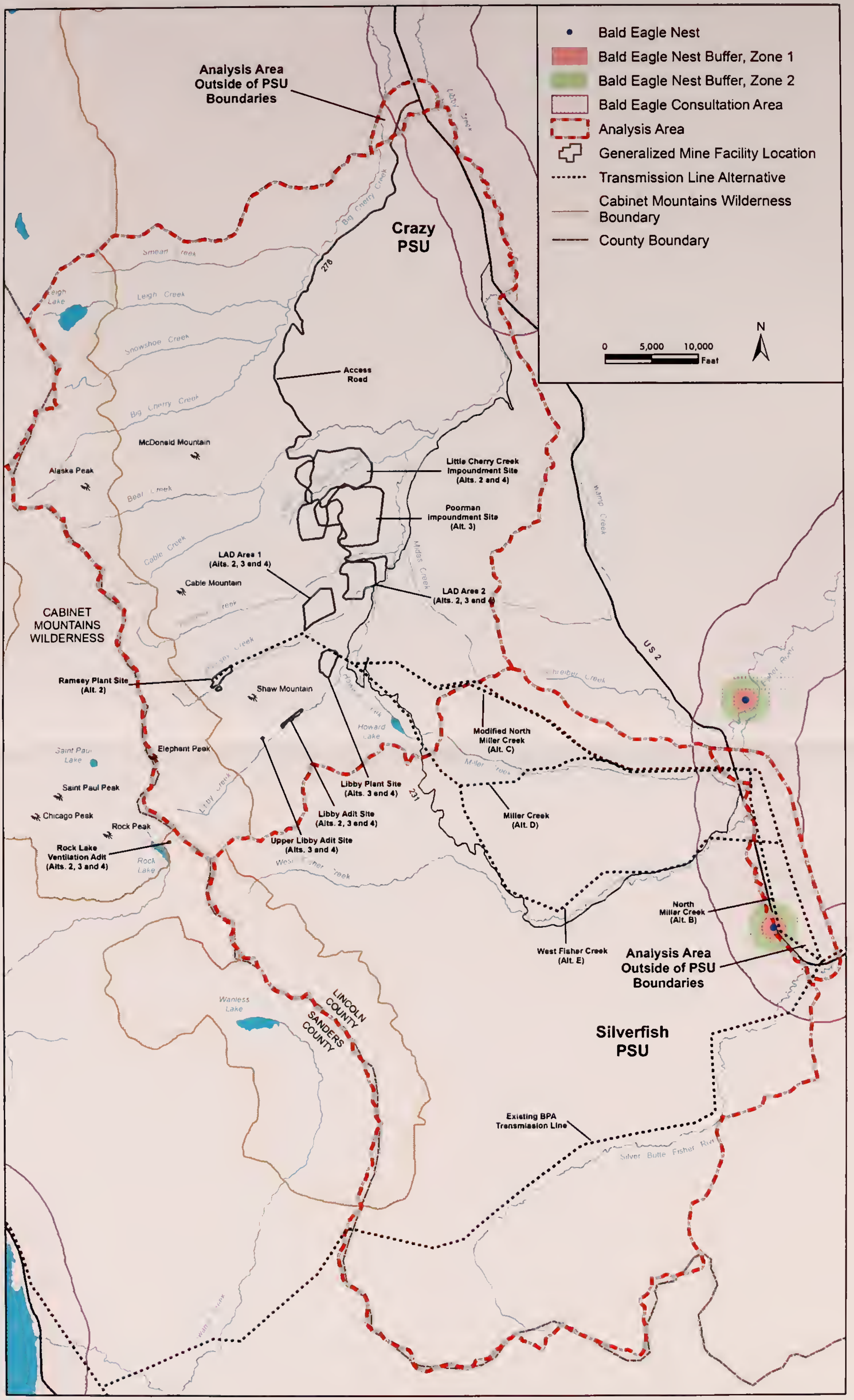


Figure 89. Bald Eagle Habitat Potentially Affected in the Analysis Area

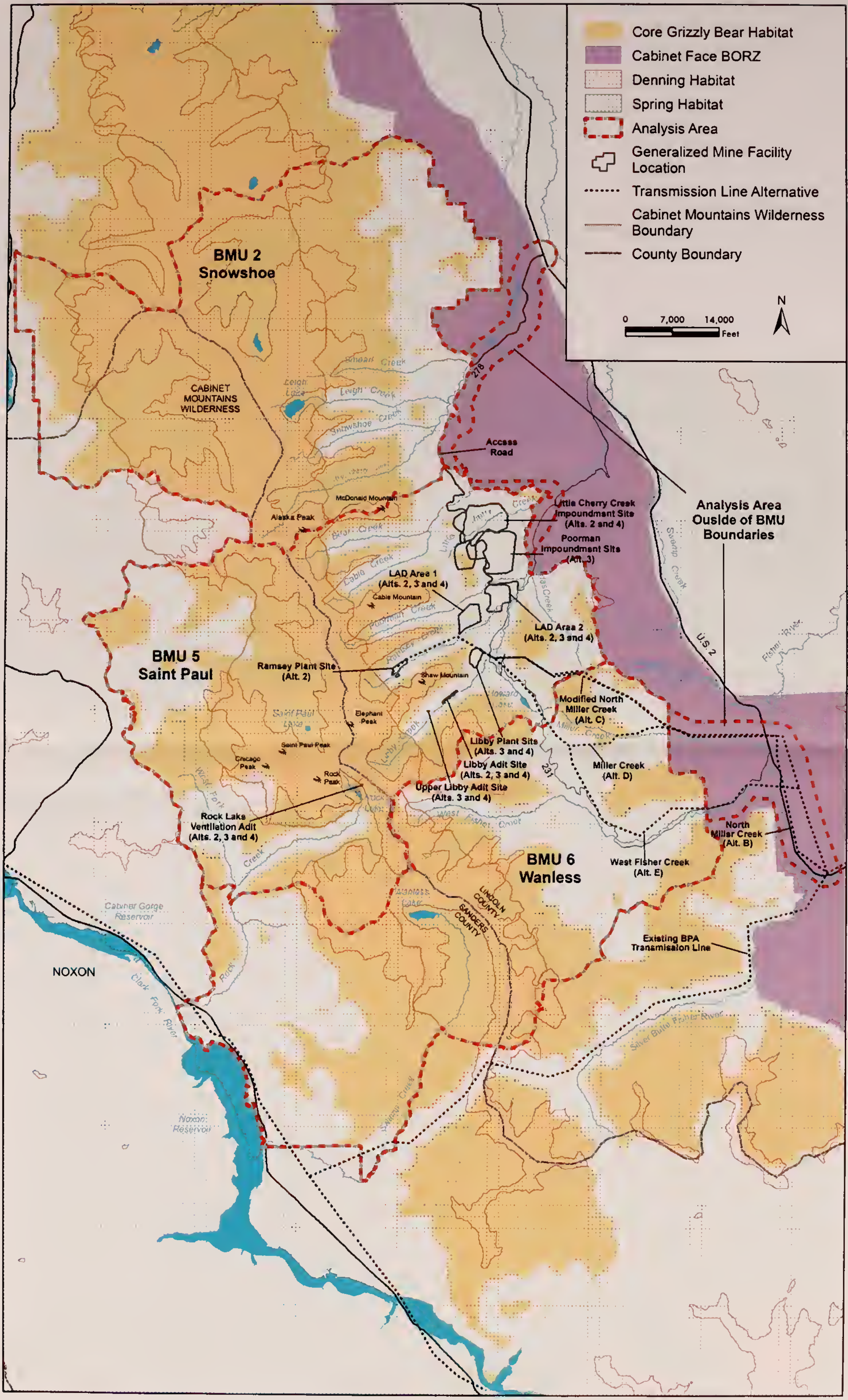


Figure 90. Grizzly Bear Habitat in the Snowshoe (2), Saint Paul (5), and Wanless (6) BMUs and the Cabinet Face BORZ

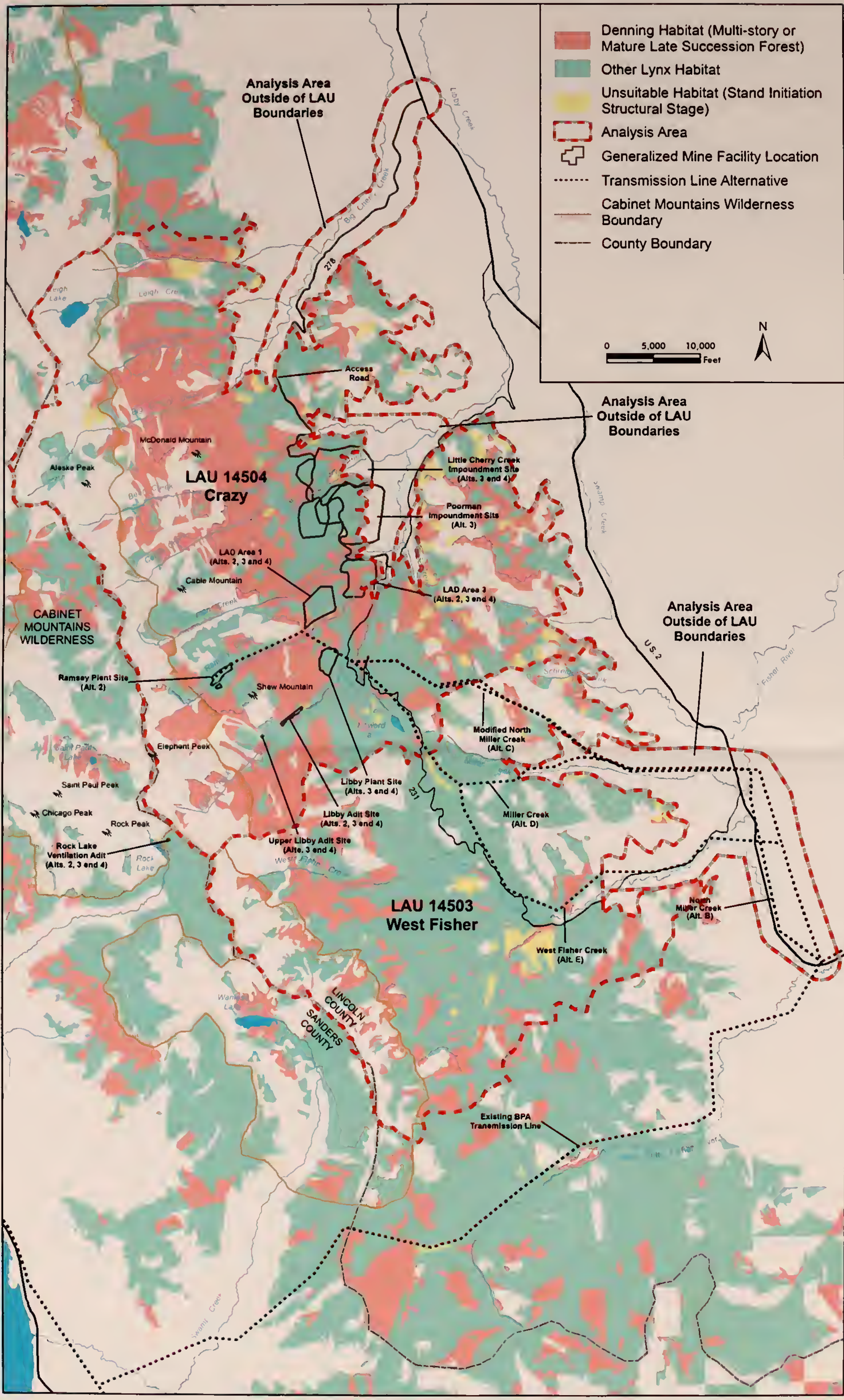


Figure 91. Lynx Habitat in the Analysis Area

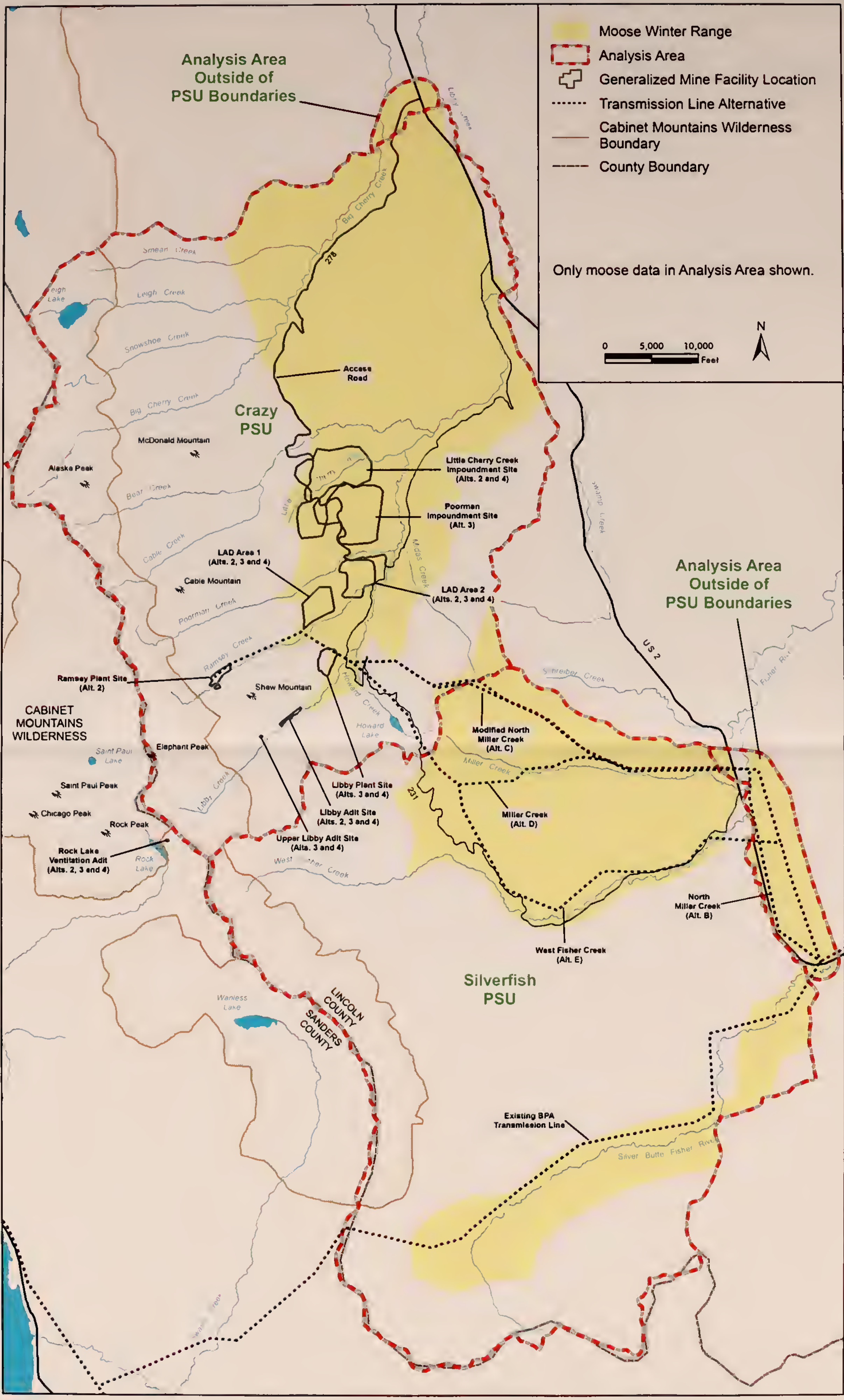


Figure 92. Moose Habitat in the Analysis Area

Appendix A—1993 Board of Health and Environmental Sciences Order

BEFORE THE BOARD OF HEALTH AND ENVIRONMENTAL SCIENCES
OF THE STATE OF MONTANA

In the Matter of the Petition for Modification of Quality of Ambient Waters Submitted by Noranda Minerals Corporation for the Montanore Project	Docket No. BHES-93-001-WQB

FINAL DECISION AND STATEMENT OF REASONS

BACKGROUND

1. The Montanore Project, a proposed underground copper and silver mine located in northwestern Montana, is a joint venture between Noranda Minerals Corporation (Noranda) and the Montana Reserves Company. The proposed project includes the development of a mine in Sanders County and the construction of a mill and associated mine waste disposal facilities in Lincoln County, 18 miles south of Libby, Montana.

2. On December 13, 1989, Noranda filed a petition for Change in Quality of Ambient Waters with the Montana Board of Health and Environmental Sciences (Board) for the proposed Montanore Project. Supplemental Information in Support of the Petition was submitted in May 1992. (The December 13, 1989 petition and the supplement submitted in May 1992 are hereinafter referred to as "Petition").

3. The Petition to allow lower water quality was submitted by Noranda because ". . . the proposed mining and milling operation cannot be designed without the expected occurrence of excess water from precipitation and mine flow." (December 13, 1989 Petition).

4. On November 20, 1992, the Board held a public hearing on

the petition to lower the quality of waters impacted by Noranda's proposed Montanore Project pursuant to ARM 16.20.705. The Board considered oral and written testimony offered prior to and at the hearing, the Petition, and the final environmental impact statement (FEIS) prepared for the proposed project by the Montana Department of Health and Environmental Sciences (Department), the Montana Department of Natural Resources and Conservation, the U.S. Forest Service, and the Montana Department of State Lands.

5. Noranda's proposed method of mine water discharge would lower the water quality for certain parameters in the surface and groundwater where the ambient quality for those parameters is higher than the applicable water quality standards. The ambient concentrations, Noranda's requested changes from ambient concentrations, and the Montana Water Quality Standards are shown in Table 1.

Table 1

Ambient quality, requested concentrations, and the Montana Water Quality Standards. All units are in mg/l.

	Existing Water Quality[a]	Noranda Requested Concentration[b]	Applicable Standard[c]
Surface Water			
Chromium	<0.02	0.005	0.011
Copper	0.002	0.003	0.003
Iron	0.08	0.1	0.3
Manganese	<0.02	0.05	0.05
Zinc	0.02	0.025	0.0271
NO3 + NO2 as N	0.13	5.5[e]	10[d]
Ammonia, Total	0.08	1.5	2.2
Tot. Diss. Solids	29	100.0	250
Groundwater			
Chromium	<0.02	0.02	0.05
Copper	<0.02	0.1	1
Iron	<0.19	0.2	0.3
Manganese	<0.45	0.05	0.05
Zinc	<0.06	0.1	5
NO3 + NO2 as N	0.36	10	10
Ammonia, Total	--	--	--
Tot. Diss. Solids	108	200	500

[a] Surface water values are based on data for Libby, Ramsey and Poorman creek given in tables 3-14 in the FEIS. Ground water values are based on data for wells in the adit, land application and tailing pond areas given in table 3-18 in the FEIS.

[b] Based on table 2-1(R) in the May 1992 Supplement to the petition.

[c] Except for nitrate these are based on the lowest applicable standard.

[d] The 10 mg/l standard is to protect public health; however, the highest allowable level which will not cause undesirable aquatic life is 1 mg/l [ARM 16.20.633 (1)(e)].

[e] Noranda changed their request to 1.0 mg/l at the Hearing

6. Pursuant to ARM 16.20.705(6), the Board's final decision on a petition to allow degradation must be accompanied by a statement of reasons stating the basis for the decision and explaining why degradation is or is not justified.

FINAL DECISION AND ORDER

The petition of Noranda to lower water quality in the groundwater and surface water adjacent to the proposed Montanore Project is granted with the following conditions:

(1) Petitioner shall provide secondary treatment or equivalent as required by ARM 16.20.631(3). The Department has determined that land treatment as proposed by the applicant, with at least 80% removal of nitrogen, will satisfy this requirement. In addition, this treatment will also satisfy the requirements of ARM 16.20.631(3) with regard to metals. Accordingly, the Department shall review Petitioner's design criteria and final engineering plans to determine that at least 80% removal of nitrogen shall be achieved.

(2) Design criteria and final engineering plans and specifications shall be submitted to the Department at least 180 days prior to any new or increased anticipated discharge from the Montanore Project and must be approved in writing by the Department prior to any activities that would cause degradation of surface or ground water.

(3) In determining allowable changes in nitrate concentration in receiving waters, the Board bases its decision on the site

specific facts of each case, taking into account the protection of beneficial uses.

In this case, the Board finds, based on the evidence presented, that the Department's recommended limit of 1.0 mg/l inorganic nitrogen in surface water should not be exceeded. The petition is therefore granted with the Department's recommended limit of 1.0 mg/l for total inorganic nitrogen in surface waters. The requested limit of 10.0 mg/l in ground water is granted subject to the following conditions. The concentration of total inorganic nitrogen in the ground water shall not exceed levels reflecting less than 80% removal by the treatment process and shall not cause exceedences of 1.0 mg/l total inorganic nitrogen in Libby, Ramsey or Poorman Creeks.

Surface and ground water monitoring, including biological monitoring, as determined necessary by the Department, will be required to ensure that the allowed levels are not exceeded and that beneficial uses are not impaired.

(4) The Board adopts into this Order the modifications developed in Alternative 3, Option C, of the Final EIS, addressing surface and ground water monitoring, fish tissue analysis and instream biological monitoring. Monitoring plans shall be submitted to the Department at least 180 days prior to any new or increased anticipated discharge from the Montanore Project and must be approved in writing by the Department prior to the commencement of any activity that would cause degradation of surface or ground water in the project area. The monitoring plan shall contain a

system of surface and ground water monitoring locations sufficient to determine compliance with this Order.

(5) Changes from ambient quality requested in the Petition for constituents, other than those containing nitrogen, will not, after treatment as specified in paragraph 1 of this Order, adversely affect beneficial uses and are therefore granted.

(6) Based on the evidence presented at the hearing, the Board has determined that Petitioner has affirmatively demonstrated that the changes granted herein are justifiable as the result of necessary social or economic development.

(7) Noranda shall provide annual funding to the department so that the department can perform sufficient independent monitoring to verify the monitoring performed by the company. Such funding shall not exceed the actual cost of such monitoring and in no case may it exceed $35,000 annually (in 1992 dollars).

(8) The provisions of this Order are applicable to surface and ground water affected by the Montanore Mine Project located in Sanders and Lincoln County, Montana, and shall remain in effect during the operational life of this mine and for so long thereafter as necessary.

STATEMENT OF REASONS

The Board's reasons for allowing a change in the ambient quality of waters impacted by the proposed Montanore Mining Project are as follows:

1. Under Section 75-5-303(1), MCA, of the Montana Water

Quality Act, the Board may authorize lower water quality if a demonstration is made that degradation is justified due to necessary economic or social development. If degradation is authorized, the Board must ensure that existing and anticipated uses are fully protected.

2. Section 75-5-303(2), MCA, requires ". . . the degree of waste treatment necessary to maintain that existing high water quality." Section 75-5-304, MCA, and ARM 16.20.631 require treatment and standards of performance for activities that may impair water quality. In particular, ARM 16.20.631(3) requires that industrial wastes, at minimum, must be treated using technology that is the best practicable control technology available (BPCTCA), or, if BPCTCA has not been determined by EPA, then the equivalent of secondary treatment as determined by the Department. If it has been demonstrated that there are no economically and technologically reasonable methods of treatment or practices that would result in no degradation, then the Board will determine whether lower water quality is justified due to necessary economic or social development. As part of this determination, the Board must require as a prerequisite BPCTCA (or if BPCTCA has not been determined by EPA, the equivalent of secondary treatment as determined by the Department). The Department has determined that land treatment as proposed by the applicant, with at least 80% removal of nitrogen shall be achieved, will satisfy the requirements of ARM 16.20.631(3) with regard to nitrogen and metals.

3. Application of treatment as discussed in the Petition would maintain existing water quality except for possible increases in nitrate, chromium, copper, iron, manganese, zinc, total dissolved solids (TDS), and ammonia. The requested increases would not adversely affect any beneficial uses except for the increase in nitrate. The effects of nitrate increases on beneficial uses are discussed below.

4. The proposal for mine wastewater disposal submitted by Noranda relies on a tailing impoundment, collection systems, and land treatment for wastewater disposal. Monitoring would be required to ensure that allowed levels of nitrate and other compounds would not be exceeded. This proposal would result in lower ambient water quality for all of the parameters that are the subject of this Petition.

5. The preferred alternative identified in the FEIS discusses land treatment prior to disposal. Water treated by the methods discussed under this alternative would substantially reduce the amounts of inorganic nitrogen in the surface and groundwater.

The testimony submitted at the hearing further confirms that land application is an appropriate treatment methodology for nitrogen reduction.

Because the land treatment proposed by Noranda would reduce suspended solids and metal concentrations on a year-round basis, the resulting concentrations of metals after dilution would not impair existing uses in these waters.

6. Published studies indicate that very low levels of

nutrients may stimulate algal growth, but that these studies have added both nitrogen and phosphorus (a situation not strictly applicable here since phosphorus would not be added in this case) and that to protect against the development of undesirable growth in streams and rivers, the Department believes inorganic nitrogen should not exceed 1.0 mg/l.

The Board, based upon the evidence submitted by the Department and by Petitioner, accepts 1.0 mg/l as the maximum allowable concentration of inorganic nitrogen in Libby, Ramsey and Poorman Creeks, for protection of all beneficial uses.

7. The analysis of land treatment in the FEIS demonstrates that this treatment (secondary treatment as defined by the Department), would achieve compliance with the allowable concentration of 1.0 mg/l of inorganic nitrogen in surface water. At the Hearing, Noranda changed its request from 5.5 mg/l of nitrate to 1.0 mg/l total soluble inorganic nitrogen. This level should adequately protect existing beneficial uses. However, biological monitoring is necessary to insure protection of beneficial uses and to assure compliance with ARM 16.20.633(1)(e), as well as other applicable standards.

8. Beneficial uses of the groundwater would not be impaired if a nitrate concentration of 10 mg/l was allowed, as requested in the petition. However, concentration of inorganic nitrogen in ground water at this level may cause violations of the standards imposed by the Board. Therefore, allowable amounts of inorganic nitrogen in ground water will be governed by the land application

treatment requirements and the surface water limits imposed by the Board.

9. Concerns were raised at the hearing regarding the ability of the Department to fund the cost of State-conducted monitoring at the Montanore Project to ensure compliance with limitations imposed by the Board in granting the Petition.

10. An analysis of the necessary economic or social development associated with the proposed project has been submitted by Noranda in its Petition and further discussed in the EIS. Further testimony was submitted by the Petitioner at the hearing regarding the importance of the Montanore Project for economic or social development in Lincoln and Sanders County. The need for the proposed project is to develop a source of copper and silver for the production of world wide commodities. Information presented to the Board indicates that the construction and operation of the Montanore Project will have beneficial economic and social impacts in Lincoln and Sanders Counties during the 18 years of its operation. Increased direct and indirect employment and increases in local government revenues associated with the mining project will benefit the impacted area. In addition, the lower water quality associated with the proposed development will be negligible.

For the reasons stated above, the Board finds that degradation resulting from the Montanore Mining Project is justified.

Dated this 20 day of November, 1992.

Raymond W Gustafson

RAYMOND W. GUSTAFSON, CHAIRMAN, BOARD OF HEALTH AND ENVIRONMENTAL SCIENCES

Appendix B—Names, Numbers, and Current Status of Roads Proposed for Use in Mine or Transmission Line Alternatives

Appendix B—Names, Numbers, and Current Status of Roads Proposed for Use in Mine or Transmission Line Alternative

Road Number	Road Name	IGBC Code	INFRA Code
1408	Libby Creek Bottom	1	99
14403	Lower Ramsey	3	09
14404	Bare Road	3	05
14405	Bear Road	3	05
14442	Lampton Pond	4	02
14458	Midasize	4	OPEN
231	Libby Creek Fisher River	4	OPEN
2316	Upper Libby Creek	2	09
2316	Upper Libby Creek	4	OPEN
2317	Poorman Creek	4	09
2317	Poorman Creek	4	OPEN
2317B	Poorman Creek B	3	09
231A	Libby Creek Fisher River A	3	05
231B	Libby Creek Fisher River B	2	05
278	Bear Creek	4	OPEN
278L	Bear Creek L	3	09
278X	Bear Creek X	3	09
385	Miller Creek West Fisher	4	OPEN
4724	South Fork Miller Creek	4	OPEN
4725	N Fork Miller Creek	2	05
4773	Howard Midas Creek	3	09
4773	Howard Midas Creek	4	OPEN
4776A	Horse Mtn Lookout A	4	OPEN
4776B	Horse Mtn Lookout B	4	OPEN
4776C	Horse Mtn Lookout C	2	09
4776F	Horse Mtn Lookout F	2	09
4777	Lower Midas-Howard Lk	3	09
4778	Midas Howard Creek	3	05
4778	Midas Howard Creek	3	OPEN
4778	Midas Howard Creek	4	OPEN
4778C	Midas Howard Creek C	4	OPEN
4778C	Midas Howard Creek C	3	05
4778C	Midas Howard Creek C	3	OPEN
4778E	Midas Howard Creek E	3	OPEN
4778P	Midas Howard Creek P	3	05
4780	Howard Lake-Miller Creek	4	OPEN
4781	Ramsey Creek	2	09
4781	Ramsey Creek	2	OPEN
4781	Ramsey Creek	4	OPEN
4781A	Ramsey Creek A	3	09
4782	Standard Creek-Miller Creek	2	05
4782A	Standard Creek-Miller Creek A	3	05
5003	Cherry Ridge A Extension	3	09
5170	Poorman Creek Unit	4	OPEN
5181	L Cherry Loop H Cowpath	2	09

Translation of IGBC and INFRA codes is available at the KNF.

Appendix B—Names, Numbers, and Current Status of Roads Proposed for Use in Mine or Transmission Line Alternative

Road Number	Road Name	IGBC Code	INFRA Code
5181A	L Cherry Loop H Cowpath A	2	09
5182	Little Cherry Bear Creek	4	09
5182	Little Cherry Bear Creek	4	OPEN
5183	Little Cherry View	3	09
5184	Bear-Little Cherry	2	09
5184A	Bear-Little Cherry A	2	09
5185	S Bear Little Cherry	2	09
5185A	S Bear Little Cherry A	2	09
5186	Ramsey Creek Bottom	3	09
5187	L Cherry Loop L Clearing	3	09
5192	Midas Bowl	3	OPEN
5192A	Midas Bowl A	3	OPEN
5326	Standard Creek-Miller Creek Oldie	3	05
6200	Granite-Bear Creek	2	09
6200D	Granite-Bear Creek D	2	09
6200E	Granite-Bear Creek E	2	09
6200F	Granite-Bear Creek F	2	09
6201	Cherry Ridge	3	09
6201A	Cherry Ridge A	3	09
6205D	Big Hoodoo D	4	OPEN
6209E	Crazyman E	4	OPEN
6210	Libby Ramsey	2	09
6212	Little Cherry Loop	4	OPEN
6212H	Little Cherry Loop H	2	09
6212L	Little Cherry Loop L	3	09
6212M	Little Cherry Loop M	2	09
6212P	Poorman Pit	2	09
6214	Cable-Poorman Creek	2	09
6214F	Cable-Poorman Creek F	2	09
6701	South Ramsey Creek	2	09
6702	South Libby Cr	1	09
6745	Standard Creek	2	05
6745	Standard Creek	3	05
6745	Standard Creek	4	OPEN
6753	Sedlak Creek	4	OPEN
6787 B	Hoodoo Bear B	4	OPEN
763	Main Fisher River	4	OPEN
8749	Noranda Mine	2	99
8749A	Noranda Mine A	2	99
8770	4W Ranch (Cactus Wade)	4	OPEN
8773	Wade's Back Entry	4	95
8838	L Cherry Ms10377 8838	2	09
8841	L Cherry Ms10377 8841	2	09
99760	Brulee-Hunter 99760	4	OPEN
99760B	Brulee-Hunter 99760B	2	99

Translation of IGBC and INFRA codes is available at the KNF.

Appendix B—Names, Numbers, and Current Status of Roads Proposed for Use in Mine or Transmission Line Alternative

Road Number	Road Name	IGBC Code	INFRA Code
99760C	Brulee-Hunter 99760C	2	99
99762	Kenelty Jump-Up 99762	4	OPEN
99763	Hunter Creek 99763	4	OPEN
99763B	Hunter Creek 99763B	4	OPEN
99764	Kenelty Mtn 99764	4	OPEN
99765	Sedlak Creek 99765	4	OPEN
99765A	Sedlak Creek 99765A	4	OPEN
99768	Sedlak Creek 99768	4	OPEN
99768A	Sedlak Creek 99768A	4	OPEN
99772	Shelley Jump Up 99772	4	OPEN
99806	Wade-Kenelty 99806	4	95
99806D	Wade-Kenelty D 99806D	2	99
99826	Middle Miller Creek. 99826	4	OPEN
99828	Miller Creek W Fisher 99828	4	OPEN
99830	West Fisher 99830	3	99
99834	Waylett Flat 99834	3	99
99834A	Waylett Flat 99834A	3	99
99844	West Fisher 99844	2	05
99845	West Fisher 99845	2	05
8773	Wade's Back Entry	4	99
99806	Wade-Kenelty 99806	2	99

Translation of IGBC and INFRA codes is available at the KNF.

Appendix C— Surface Water, Ground Water, and Aquatic Life Monitoring Plans, Alternatives 3 and 4

1.0 Water Resources Monitoring Plan

MMC proposes to construct an underground mine that would require the construction of several associated features, such as a tailings impoundment and one or more LAD Areas for disposal of water. The mine and adits, tailings impoundment, and LAD Areas have the potential to affect surface and ground water quality and quantity in the area. The objective of the surface and ground water monitoring program is to establish pre-construction conditions, and then periodically monitor those conditions as the facilities are constructed and operated. Water resources monitoring goals would be to quantify any measurable environmental impacts accompanying construction, operation or reclamation of the mine project, and to determine whether modifications to project operations or additional mitigation actions would be required to correct any unanticipated impacts encountered, or to prevent future violations of regulatory requirements.

MMC and its predecessors have collected and reported pre-construction or baseline surface and ground water quantity and quality data (see Chapter 3). Additional monitoring would be required to supplement this original data collection and provide long-term monitoring for the project. This monitoring plan does not include all compliance monitoring that may be required by a MPDES permit. Monitoring programs would be maintained during the life of the project. Post-mining surface and ground water monitoring would be continued for a period of time to be specified by the agencies during review of MMC's Final Closure Plan. This plan discusses the monitoring requirements, frequency, reporting, and other important aspects of the monitoring program.

The monitoring program associated with the Libby Adit MPDES permit is currently being implemented. MMC is currently collecting quarterly samples from Outfall 001 for flow rate, temperature, nutrients, sulfate, and metals. When exploration or mining began, MMC would also sample the same parameters quarterly at LB-300.

1.1 Funding

As discussed in section 3.10, *Ground Water Hydrology* and section 3.12, *Surface Water Quality* of Chapter 3, the Board of Health and Environmental Sciences (the Board of Environmental Review's predecessor) approved a "Petition for Change in Quality of Ambient Waters" to increase the concentration of select constituents in surface and ground water above ambient water quality. The Order remains in effect and MMC would be responsible for ensuring compliance with the Order's provisions. One provision of the Order was the funding to the DHES (now DEQ) so that the DEQ could perform sufficient independent monitoring to verify monitoring performed by Noranda (now MMC). Such funding would not exceed the actual cost of such monitoring, and in no case, exceed $35,000 annually (in 1992 dollars). MMC would provide funding to the DEQ for verification monitoring of the project; $35,000 in 1992 dollars is $54,000 (2008 $), using the Consumer Price Index as the inflation factor. The funding would increase annually in accordance with the Consumer Price Index.

However, additional site-specific pre-construction data would be necessary for any new monitoring site that was established to satisfy this monitoring plan to ensure that site-specific baseline data exist prior to construction of each facility. The monitoring program targets both surface and ground water resources located within and outside the CMW. Monitoring objectives would differ between monitoring locations. Some locations mainly in the CMW are focused on

detecting changes in ground water levels and discharge, whereas monitoring locations in the mine facilities area would be more focused on potential contaminant excursions.

Data collection would be initiated in both areas 1 year prior to initiation of construction activities. Once the initial surveys and data collection programs were completed, the plan may be modified to reflect actual field situations identified. Potential impacts to water resources may not occur immediately and for this reason, data collection location and frequency may be adjusted to match the mine development schedule; where appropriate. Monitoring needs for different phases of the project would be considered in the monitoring plan and include pre-construction, construction, mine operation, and post-closure.

MMC would implement the monitoring programs 1 year prior to the start of construction and would collect surface water flows, ground water levels and water quality samples quarterly, and at specific locations, collect at least one sample during or immediately after a storm event that produces runoff. This would assist with understanding pre-construction conditions and establish pre-construction site-specific baseline data for newly installed monitoring locations.

The water resources plan includes monitoring within and adjacent to the CMW would include both surface and ground water resources and is intended to monitor the baseline conditions of waters that lie above and peripheral to the ore body. Monitoring objectives would focus on water quantity, and ground water dependent ecosystems. Water quality would also be monitored and would be important for some locations. The primary objectives for wilderness water resources monitoring are:

- Establish baseline environmental conditions
- Monitor for potential surface and ground water effects during mine construction, operations, and after closure
- Correlate information with hydrology data collected from the underground workings

Wilderness area water resources include:

- Rock Lake (RL)
- St. Paul Lake (SPL)
- Lower Libby Lake (LLL)
- East Fork Bull River (EFBR)
- East Fork Rock Creek (EFRC)
- Springs/seeps/adit discharge above and around the orebody
- Wetlands/riparian areas associated with springs and seeps and streams
- Ground water

Water resources monitoring would also be conducted around the mine facilities and activities. The objective of this monitoring would focus on water quality, aquatic life habitat, wetlands and riparian habitat however water quantity would also be monitored. These water resources include:

- Libby Creek (LB)
- Ramsey Creek (RA)

- Poorman Creek (PM)
- Bear Creek (BC)
- Miller Creek (dependent on the alternative selected) (MC)
- West Fisher Creek (dependent on the alternative selected) (WFC)
- Springs/seeps adjacent to mine operations
- Wetlands/riparian areas adjacent to mine operations
- Ground water adjacent to the adits, LAD Areas and Tailings Impoundment
- Mine Water
- Process Water
- Water Balance

1.2 Ground Water Dependent Ecosystem Inventory

1.2.1 GDE Inventory Objectives

The intent of the monitoring program is to provide long-term monitoring of the water resources and ground water dependent ecosystems that could be impacted by the mine. Prior to construction or underground excavation, MMC would complete a comprehensive ground water dependent ecosystem (GDE) inventory (springs, wetlands, fens, flora, fauna, hyporheic zones, gaining reaches of streams) focusing on areas below about 5,600 feet. The inventory area is shown on Figure C-1. A GDE inventory would be needed because a comprehensive inventory of the resources overlying the proposed mine facilities has not been completed. An inventory would help identify and rank GDEs based on their importance in sustaining critical habitats or species and the most important or vulnerable ones would be targeted for monitoring. The inventory would be conducted in accordance with the most current version of the Forest Service's *Ground-Water Resource Inventory and Monitoring Protocol* (USDA Forest Service 2006a).

1.2.2 Springs Inventory

The inventory area is shown on Figure C-1 would be surveyed for springs. In this initial inventory, the flow of spring would be measured twice, once in early June or when the area was initially accessible, and once between mid-August and mid-September. The most accurate site-specific method for measuring spring flow would be used, which may include the use of a flume, weir, flow meter or timed volumetric measurement. Any spring with a measurable flow between mid-August and mid-September would be assessed for its connection to a regional ground water system, based on flow characteristics (e.g. possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation), water chemistry, and the hydrogeologic setting (associated geology such as the occurrence or absence of colluvium or alluvium).

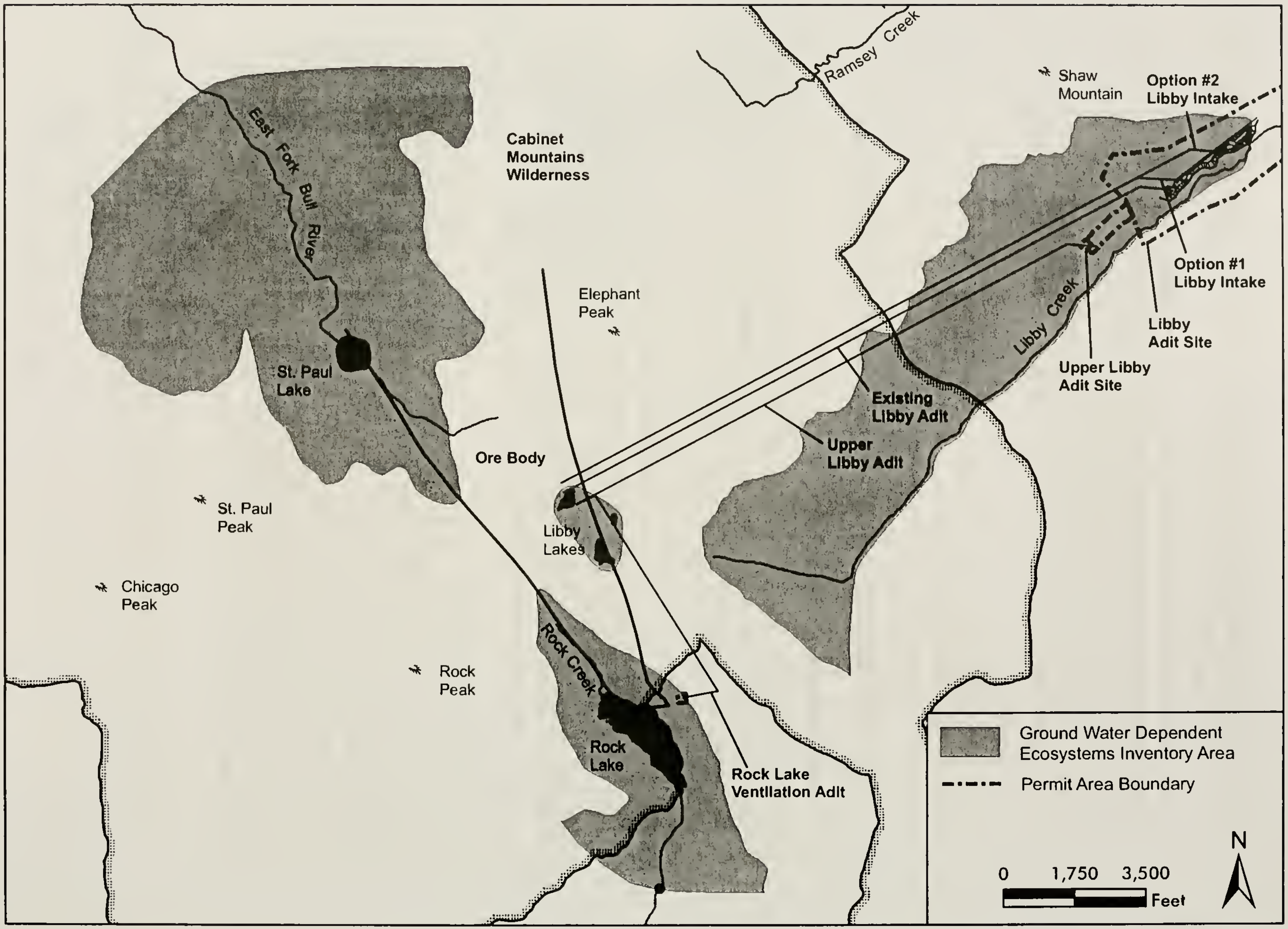


Figure C-1. Proposed Ground Water Dependent Ecosystems Inventory Areas

1.2.3 Wetland and Riparian Vegetation Inventory

The inventory area, shown on Figure C-1, would be surveyed for ground water dependent wetlands, fens and riparian areas. At each critical GDE habitat identified from the inventory, a vegetation survey would be completed. A botanist/plant ecologist or other qualified individual would design survey methodology and protocols which would be approved by the agencies. Initial survey data would include site photos and points, GPS site locations, basic site descriptors, and plant species composition, focusing on hydrophytes (plants that are able to live either in water itself or in very moist soils).

1.2.4 Stream Baseflow Inventory

In the initial inventory, the flow of any stream in the GDE inventory area (Figure C-1) would be measured when the area was initially accessible, monthly during the summer months and weekly between mid-August and mid-September. The most accurate site-specific method for measuring stream flow would be \used, which may include the use of a flume, weir, flow meter or timed volumetric measurement. Any stream with a measurable flow between mid-August and mid-September would be assessed for its connection to a regional ground water system, based on the associated hydrogeology such as faults or the occurrence or absence of colluvium and/or alluvium and possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation. Gaining stream reaches would be mapped, and then monitoring locations would be refined to focus on gaining reach lengths and flow.

1.2.5 Lakes Inventory

Beginning 1 year prior to construction, the levels of Rock Lake, St. Paul Lake, and Lower Libby Lake, which all overlie the proposed mine, would be measured continuously. Each lake would be assessed for its connection to a regional ground water system, based on water balance, the associated hydrogeologic characteristics such as faults or the occurrence or absence of colluvium and/or alluvium and possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation.

1.3 Ground Water Dependent Ecosystem Monitoring

1.3.1 GDE Monitoring Objectives

GDE monitoring would have locations and frequency specified based on inventory data and on the local hydrogeology and proximity to the mine or adit void. The objective of GDE monitoring would be to detect changes in ecological integrity of dependent species and habitat. A GDE Monitoring and Mitigation Plan would be developed for important GDEs found during the inventory that would most effectively detect and minimize stress to flora and fauna from surface effects of mine dewatering. The plan would be submitted to the agencies for approval after the GDE inventory is completed and early enough for 1 year of baseline data to be collected before mining begins. The plan would include piezometers in critical locations. The plan would include a monitoring schedule, a mitigation plan, and mitigation implementation triggers. The results of the initial inventory, subsequent inventories, and monitoring would be reported in annual reports to the lead agencies.

There are several criteria required to decide which characteristics to monitor, including traits that 1) *have a defined relationship with ground water levels*; there needs to be confidence that a

measured response within a parameter reflects altered ground water levels rather than other abiotic/biotic factors; 2) *are logistically practical;* parameters should be practical to measure within the constraints of a wilderness setting; parameters that reflect landscape responses by GDEs of wide distribution, such as remote sensing of hydrophytic vegetation health, could be considered; 3) *have early warning capabilities*; it is important to consider the lag time between changed ground water levels and environmental condition or health. The response of vegetation parameters influenced by changed ground water levels can take a long time to become manifest and further reductions may occur before impacts of previous changes are realized; consequently, parameters with rapid responses are favored (e.g. piezometers), as they provide advanced warning of significant stress or degradation on the system, as well as providing the opportunity to determine whether intervention or further investigation is required. Nevertheless, some GDE values may have to be measured through parameters with a greater lag time (e.g. hydrophytic vegetation community composition).

Table C-1 below identifies the specific monitoring options for surface resources in the area. After the initial survey, this table would help to establish the methods that would be used to monitoring GDEs.

Table C-1. Ground Water Dependent Ecosystem Monitoring Options, Alternative 3 and 4.

Surface Resource Component	Look For:	Using:
Springs, Lakes, and Streams	Flow changes	Flow monitoring
	Lake level changes	Continuous level recorder
	Ground water level changes	Piezometers
Wetland and Riparian Vegetation	Ground water level changes	Piezometers
	Dieback, early desiccation, habitat decline	Photo points, field surveys, remote sensing
	Soil moisture stress	Tensiometers
	Plant water potential/ turgor pressure changes	Pressure bomb technique
Amphibians, Mollusks, Macroinvertebrates, Fish	Population decline, community composition change	Field surveys
Terrestrial animals	Population/usage decline	Field surveys

1.3.2 Springs Monitoring

The flow in springs determined to be supported by the regional ground water system or whose connection to the regional ground water system was uncertain would be measured annually between mid-August and mid-September. A spring that was determined, after repeated flow measurements, not to be connected to the regional ground water system may be eliminated from additional monitoring. However, additional monitoring of flow and quality of any spring overlying the proposed mine may be required, depending on the outcome of the GDE inventory. Flow monitoring of springs or streams, by itself, is generally inadequate because mining induced impacts are frequently subtle and hard to distinguish from natural variability. Flow monitoring can only detect relatively large mining induced changes in flow.

1.3.3 Wetland and Riparian Vegetation Monitoring

Indicator hydrophytes and their distribution and frequency would be chosen from the initial survey information and identified as "trigger plants." Trigger plants would serve as a basic "trigger" to begin annual monitoring in a particular site. Other monitoring options such as piezometers would be used to facilitate or strengthen monitoring effectiveness. If a change in seep or spring flow, water level, or water quality is noted outside the baseline data for an individual site or set of sites, then a re-evaluation of those potentially affected habitats would be conducted and documented for comparison against initial survey information. Depending on a combination of biological or physical variables or the severity of plant indicator decline, the lead agencies may require more rigorous monitoring. Potential monitoring options for wetlands (including fens) and riparian areas are shown in Table C-1.

1.3.4 Stream Baseflow Monitoring

Streamflow determined to be supported by the regional ground water system or whose connection to the regional ground water system was uncertain would be measured continuously for water level changes between July 15 and October 15 every year. Where streamflow was determined, after repeated flow measurements, not to be connected to the regional ground water system, such locations may be eliminated from additional monitoring. However, additional monitoring of streamflow and water quality of any stream overlying the proposed mine may be required, depending on the outcome of the GDE inventory.

1.3.5 Lake Monitoring

Lake monitoring would include indicators to assess trophic status, ecological integrity and lake physical characteristics. MMC would implement monitoring at Rock Lake, St. Paul Lake and Lower Libby Lake at least 1 year prior to the start of mining to provide data to establish the pre-construction water balance of the lakes. Lake monitoring should be based on the EPA and Forest Service lake monitoring protocols (USDA Forest Service 2001, 2006a, 2006b; EPA 2007b). Major water budget variables would be accounted for and/or estimated, including evaporation, precipitation, seepage, and surface water inflows and outflows, as well as the continuously recorded lake levels, to develop lake water balances. The lake monitoring system design and evaluation would be coordinated with the KNF and the DEQ because of physical difficulties such as access, vandalism, avalanches, and reliability of the data. Lake monitoring would continue throughout the mining period. When mining is completed, the agencies would determine if continued monitoring of the lakes is needed. Pre-construction water balances and trend observations would be used to determine whether the lake levels were affected during mining operations. MMC would collect lake water quality data quarterly beginning 1 year prior to construction. This would include samples from the lake inlet, outlet and the deepest part of the lake. Samples would be collected as soon as the lakes melt in the spring, during mid-summer, late summer, and in the fall before the lakes freeze. Monitoring data and evaluation (lake water balance and water quality) would be submitted to the lead agencies within 30 days after quarterly water quality data collection.

A permanent index location for lake water quality sampling should be determined during the first year of sample collection using a depth finder and by triangulation with landmarks around the lake. This location should have good hydrologic connection with the main mass of water and should be in the deepest area of the lake. Each time the lake is to be revisited for sampling the index location should be relocated as close as possible (USDA Forest Service 2006a). Each lake

would need to be measured to determine if the lake is thermally stratified (method is described in USDA Forest Service 2006a). For thermally mixed lakes, one epilimnion (upper warm water) would be collected at the index location at a depth of 0.5 meter below the lake surface. For thermally stratified lakes such as Rock Lake, two samples would be located at the index location at a depth of 0.5 meter below the lake surface and hypolimnion (lower cold water) sample would be collected at a depth determined 3 meters below the thermocline (the transition zone between the epilimnion and hypolimnion) or at the mid-depth of the hypolimnion, whichever is the lesser to minimize the chance of hitting the lake bottom and kicking up sediment. A Van Dorn sampler should be used to collect the deeper water sampler.

1.4 Surface Water Monitoring

Surface water monitoring would be divided between those locations where water quality could be affected mainly by dewatering from the adits and underground workings (Quantity Focus Locations) and those that could be affected by mine activities (Quality Focus Locations). Surface water monitoring stations would include sites shown in Figure C-2.

1.4.1 Quantity Focus - Locations

Quantity focused surface water sites would be monitored for flow and a limited list of indicator quality parameters during the life of the project. Initially, water quality may be measured for a larger set of parameters to obtain information prior to mine activities and then monitored for a smaller set of key parameters throughout project life (Table C-2). If changes to flow or quality are deemed to be significant, then additional monitoring may be required to determine if the changes are mine related.

Quantity Focus surface water monitoring stations (Table C-2) include:

- East Fork Rock Creek (EFRC)
- East Fork Bull River (EFBR)
- Rock Lake (RL)
- St. Paul Lake (SPL)
- Lower Libby Lake (LLL)
- Key monitoring sites identified following the GDE inventory

The monitoring locations were chosen based on where baseline sampling has occurred and/or where construction or mining operations may most likely affect surface water flow. The locations are proposed and could be subject to change. Likewise, additional sites may be added following the results of the GDE Inventory and/or agency review. Surface water monitoring locations for the project would be based on final agency review and approval.

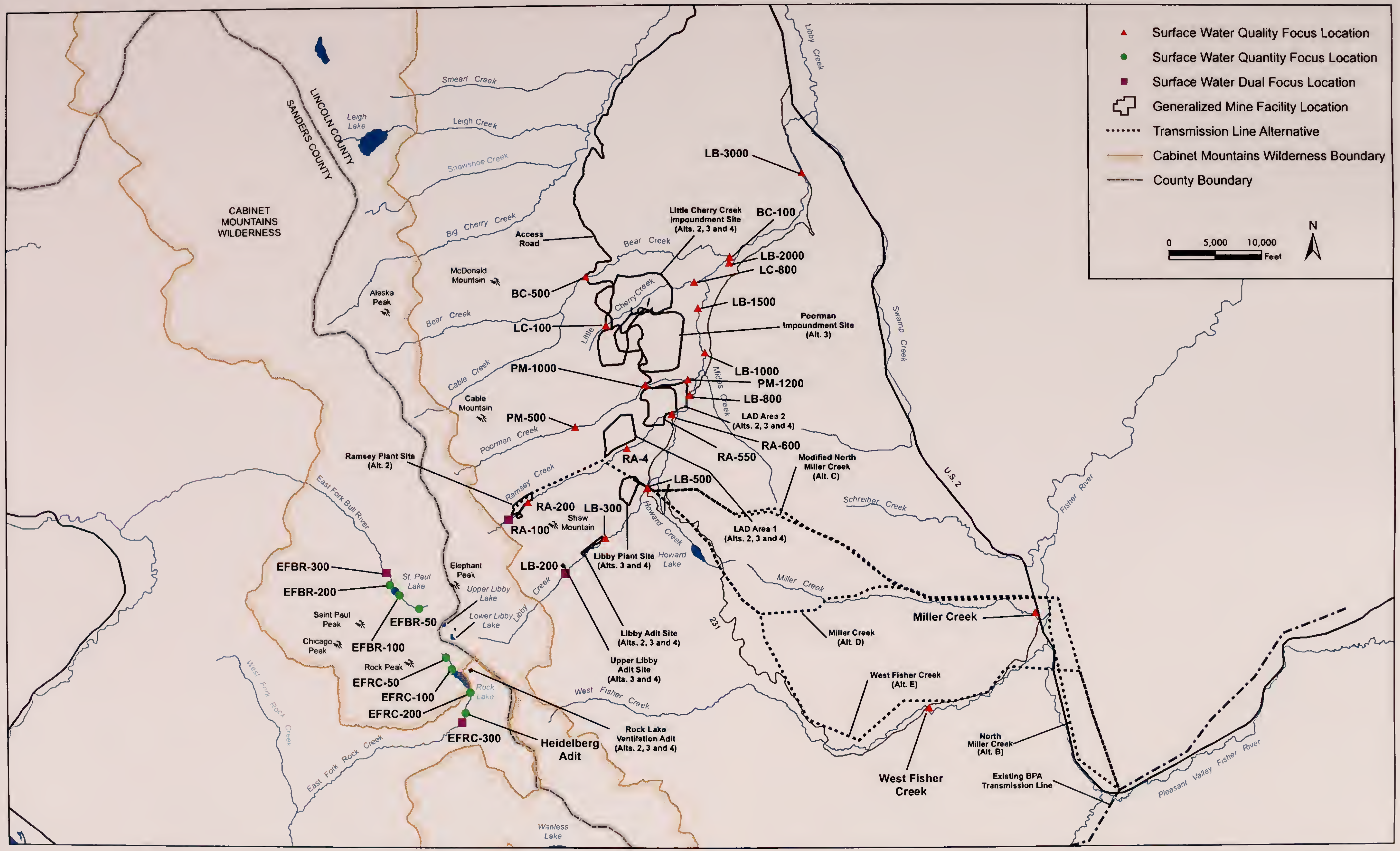


Figure C-2. Proposed Surface Water Monitoring Locations

1.4.2 Quantity Focus - Frequency

If accessible, monitoring would occur in the streams/lakes listed in Table C-2 at the following frequency:

- Early spring low flow conditions
- High flow (snowmelt runoff)
- Late summer (base flow)
- October-November (fall low flow)

The flow of Rock Creek above Rock Lake (EFRC-50) would be measured between July and October using a flume or weir that could measure low flow. Water levels would be recorded continuously. The purpose of this monitoring would be to identify when base flow occurs, to quantify the base flow and to detect possible reductions in base flow. A continuous flow station would also be installed at EFRC-200 and data would be collected when the stream is accessible and not frozen. Spring monitoring would occur at springs during June high flow snowmelt runoff, or when accessible, and between mid-August and mid-September during the late summer base flow period.

Table C-2. Surface Water Monitoring Sites – Quantity Focus Locations.

Station	Location	Alternative	Objective
East Fork Rock Creek			
New EFRC-50	Just below SP-31	All	Monitor dewatering
EFRC-100	Above Rock Lake	All	Monitor dewatering
EFRC-200	Below Rock Lake where measurable (such as at exposed bedrock slightly downstream from lake)	All	Monitor dewatering
EFRC-300	Above Rock Creek Meadows	All	Monitor dewatering
Heidelberg Adit	Below Rock Lake	All	Monitor dewatering
East Fork Bull River			
New EFBR-50	Just below SP-32	All	Monitor dewatering
New EFBR-100	Above St. Paul Lake, where stream crosses exposed bedrock	All	Monitor dewatering
New EFBR-200	Below St. Paul Lake where measurable	All	Monitor dewatering
New EFBR-300	At base of steep slope below St. Paul Lake where measurable	All	Monitor dewatering
Libby Creek			
LB-200	Above Libby Adit	All	Monitor dewatering
Ramsey Creek			
RA-100	Near Ramsey Adits	All	Monitor dewatering
Wilderness Lakes			
Rock Lake	Continuous water level recorder	All	Monitor dewatering
St. Paul Lake	Continuous water level recorder	All	Monitor dewatering
Lower Libby Lake	Continuous water level recorder	All	Monitor dewatering

1.4.3 Quantity Focus - Parameters

A select list of water quality parameters to be sampled for and analyzed at each surface monitoring location is provided in Table C-3. As mentioned earlier, additional baseline information may be collected prior to mine activities, but routine monitoring of wilderness waters would only include a small set of key variables that are most likely to show change over time. Flow measurements would also be taken. Laboratory analytical methods should conform with those listed in 40 CFR 136. Laboratory detection limits would need to be low enough to detect existing water quality concentrations and, therefore, changes in water quality concentrations in lakes, streams and springs.

Table C-3. Proposed Monitoring Parameters and Detection Limits – Quantity Focus Locations.

Parameter	Detection Limit
Flow	
pH (s.u.)	
Dissolved Oxygen	0.1
Specific Conductivity (μS/cm)	1.0
Turbidity	

1.4.4 Quality Focus Locations

The following surface water monitoring is being developed to establish baseline environmental conditions as well as resource monitoring during mine operations. The surface water monitoring would be focused on water quality but water quantity is also important. Water quality issues would vary depending on the planned mined activities. This plan is developed to focus on the specific water quality issues for each discreet project facility (i.e. tailing impoundment, LAD Areas). In addition, aquatic habitat would be monitoring with the same objective and is described in *Aquatic Biology Monitoring*. Table C-4 provides the general objectives for each area.

Table C-4. Surface Water Monitoring Objectives – Quality Focus Locations.

Mine Area	Stream Areas	Objective
Ramsey Plant Site	Libby Creek – middle reaches Ramsey Creek – middle reaches)	Sediment, Habitat, Water Quality (flow)
LAD Areas	Ramsey Creek – lower and middle reaches Poorman Creek – lower and middle reaches	Sediment, Habitat, Water Quality (flow)
Libby Adit and Libby Plant Site	Libby Creek – upper and middle reaches	Sediment, Habitat, Water Quality (flow)
Tailings Impoundment	Little Cherry Creek Libby Creek – middle reaches	Sediment, Habitat, Water Quality (flow)
Underground void	EFRC-300	Water Quality
Underground void	EFBR-300	Water Quality

Surface water would be monitored for quality and flow during the life of the project for the majority of monitoring stations. For some locations, monitoring would be conducted only to detect impacts during the construction period. Surface water monitoring stations would include the following sites shown in Figure C-2 and provided in Table C-5:

- Libby Creek
- Ramsey Creek
- Little Cherry Creek
- Poorman Creek
- Unnamed Tributary of Miller Creek (if the North Miller Creek TL Alternative or Modified North Miller Creek TL Alternative was chosen) – Construction Only
- Miller Creek (if the Miller Creek TL Alternative was chosen) – Construction Only
- West Fisher Creek (if the West Fisher Creek TL Alternative was chosen) – Construction Only
- Bear Creek (if Alternative 2 or 4 was chosen)
- Springs
- Other monitoring sites identified following the GDE Inventory (springs/seeps/streams) within the project areas (adit, plant site, with or downgradient of the LAD Areas, and within or downgradient of the tailings impoundment

In alternatives 3 and 4, an identified spring between the two LAD Areas (SP-21 see Figure 72) would be part of the monitoring. The sample locations were chosen based on where baseline sampling has occurred and/or where construction or mining operations may most likely affect streamflow and/or water quality. The locations are proposed and could be subject to change or additional sites may be added. Surface water monitoring locations for the project would be based on final agency review and approval.

1.4.5 Quality Focus - Frequency

Monitoring would occur in the streams listed in Table C-5 at the following frequency:

- March-April (early spring, low flow)
- June, high flow (snowmelt runoff)
- August-September (late summer base flow)
- October-November (fall low flow)

In addition, in-stream flow and water quality samples would be collected during or immediately after at least one storm event that produces observable surface runoff. Sample time periods may be changed to better represent stream conditions, based on flow data collected. Spring monitoring would occur in the springs listed in Table C-5 during June high flow snowmelt runoff and in August to September during the late summer base flow period.

1.4.6 Quality Focus - Parameters

Water quality parameters to be sampled for and analyzed at each surface monitoring location are provided in Table C-6. Laboratory analytical methods should conform with those listed 40 CFR

136. Laboratory detection limits would need to be low enough to detect existing water quality concentrations and, therefore, changes in water quality concentrations in surface water.

Continuous flow stations would be installed at LB-2000, EFRC-200, EFBR-100, and in Libby Creek and Ramsey Creek at the CMW boundary and measurements collected when the streams are not frozen. Other continuous flow stations may be installed based on the GDE stream inventory at locations determined to be gaining streams supported by the regional ground water system.

The following sediment sampling schedule would be established for sediment and turbidity sampling at LB-2000:

- Daily (during construction activities)
- Every other day (during initial mine operation)
- Once per week (during mine operations/reclamation).

If possible, daily suspended sediment samples and turbidity measurements would be collected with an automated sampler. If samples were not collected with an automated sampler, then daily samples would be collected using a depth integrated sampler at various times during each of the three shifts during construction. This could be reduced to every other day collection during the three shifts once mine operations were initiated. After the initial mine development, the samples could be reduced to weekly or as required by the MPDES permit monitoring stipulations. Sample collection times would be selected to reflect representative mine activities.

Weekly suspended sediment sampling and turbidity measurements would occur during construction of the transmission line immediately below any and all stream crossings and would occur within 36 hours after a storm causing surface runoff. Weekly sediment sampling and sampling within 36 hours after a storm (this intensity of sampling would allow for the majority of the sediment to settle out before measurement. I would suggest that we require "storm –event sampling" to occur during the event not 36 hours after it) causing surface runoff also would occur in streams located within 0.25 mile of disturbed areas greater than 1 acre in size during construction activities, including, but not limited to the mill site, borrow areas, tailings impoundment, adits, waste rock storage areas, land application disposal areas and access roads.

For the transmission line monitoring sites, samples would be collected weekly at all major stream crossings during construction and analyzed for specific conductivity and turbidity. After construction of the transmission line was complete, water quality sampling would no longer be required unless erosion into the stream continues to be observed where the transmission line was located adjacent to or crosses the stream.

Table C-5. Proposed Surface Water Monitoring Locations – Quality Focus Locations.

Station	Location	Alternative	Purpose
		Libby Creek	
LB-200	Above Libby Adit	All	Reference station on upper Libby Creek
LB-300	Upstream of Howard Creek Confluence	All	Assess Libby Creek adit site areas
LB-500	Near Libby Plant Site	Alternatives 3 and 4	Assess Libby Creek Plant site
LB-800	Near LAD Areas	Alternative 2	Monitor LAD discharge
LB-1000	Downstream of Poorman Creek/Midas Creek Confluence	All	Monitor Ramsey Plant Site and LAD Areas
LB-1500	Downstream of LB-1000 about 3,000 feet, downstream of Poorman TI site	Alternative 2	Monitor Poorman Tailings Impoundment site
LB-2000	Downstream of Little Cherry Creek Confluence	All	Monitor Below the Tailings Impoundment
LB-3000	Upstream of Crazyman Creek Confluence	All	Monitor Cumulative Activities
		Ramsey Creek	
RA-100	Above Ramsey Plant Site	Alternative 2	Reference station on upper Ramsey Creek
RA-200	Below Ramsey Plant Site	Alternative 2	Monitor Plant Site, outfall 008
New RA-400	Below LAD Area 1	All	Monitor LAD discharge
RA-600	Above Libby Creek Confluence	All	Monitor lower LAD discharge
		Little Cherry Creek	
LC-100	Above tailings impoundment	Alternatives 2 and 4	Reference station on upper L. Cherry Creek
LC-800	Above Libby Creek Confluence	Alternatives 2 and 4	Monitor tailings area activities
		Poorman	
PM-500	Upstream on Poorman Creek	All	Reference station on upper Poorman Creek
PM-1000	Above Libby Creek Confluence	Alternatives 3 and 4	Monitor LAD discharge
New PM-1200	Below LAD Area 2	Alternative 2	Monitor lower LAD discharge outfall 007
		Bear Creek	
BC-100	Below tailings impoundment	Alternatives 2 and 4	Monitor project activities
BC-500	Above any disturbance and NFS road #278	Alternatives 2 and 4	Provide reference on upper Bear Creek
		East Fork Bull River	
EFBR-300	At base of steep slope below St. Paul Lake where measurable	All	Monitor mining activities
		East Fork Rock Creek	
EFRC-300	Above Rock Creek Meadows	All	Monitor mining activities
		Drainages In Transmission Line Areas	
Miller Creek	Upstream of Fisher River	Alternatives B, C and D	Monitor transmission line construction
West Fisher Creek	Approximately 2.5 mi above Fisher River at NFS road #231 crossing	Alternative E	Monitor transmission line construction

Table C-6. Proposed Monitoring Parameters and Detection Limits – Quality Focus Locations.

Parameter (Non-metals)	Detection Limit (mg/L unless otherwise specified)	Parameter (Metals total recoverable unless otherwise specified)	Detection Limit (mg/L)
pH (s.u.)	0.1	Aluminum, dissolved (0.45 µm filter)	0.03
Dissolved oxygen	0.1	Antimony	0.003
Specific conductivity (µS/cm)	1.0	Arsenic	0.001
Total dissolved solids	1.0	Barium	0.005
Total suspended solids	1.0	Beryllium	0.001
Sodium	1.0	Cadmium	0.0001
Calcium	1.0	Chromium	0.001
Magnesium	1.0	Copper	0.001
Potassium	1.0	Iron	0.05
Carbonate	1.0	Lead	0.0005
Bicarbonate	1.0	Manganese	0.005
Chloride	1.0	Mercury	0.00001
Sulfate	1.0	Nickel	0.01
Nitrate+nitrite, as N	0.01	Selenium	0.001
Total Kjeldahl nitrogen, as N	0.1	Silver	0.0002
Total phosphorus,as P	0.005	Thallium	0.0002
Ortho-phosphate	0.005	Zinc	0.001
Ammonia, as N	0.05		
Field temperature	-		
Total alkalinity (as $CaCO_3$)	1.0		
Total hardness (as $CaCO_3$)	1.0		
Turbidity (NTU)	0.1		
Chemical oxygen demand‡	5.0		
Oil and grease‡	1.0		

‡For discharges associated with stormwater runoff.

1.5 Ground Water Monitoring

1.5.1 Introduction

Ground water monitoring would be required for the purpose of detecting water quality impacts from mine area facilities and for detecting ground water level changes from the underground mine and adits. A summary of all ground water monitoring requirements are shown on Table C-7.

Table C-7. Summary of Ground Water Monitoring Requirements.

Well Number	Location	Depth/Screen Interval	Required Data	Monitoring Frequency	Purpose
Libby Creek Drainage					
MW07-1 and MW07-2	Downgradient of adit facilities	Existing wells at Libby Adit	Water Levels Water Quality	Quarterly	Assess potential impacts from Libby Adit discharge
Ramsey Creek Drainage					
3	Upgradient Plant Site	WT plus 50 feet	Water Levels Water Quality	Quarterly	Background data
4	Downgradient Plant Site	WT plus 50 feet	Water Levels Water Quality	Quarterly	Assess potential impacts from Plant site
LAD Area 1					
5s and d, 6s and d, and 7s and d	Downgradient of LAD 1	s: 0 – WT plus 20 feet d: WT plus 20 feet – WT plus 50 feet	Water Levels Water Quality	Monthly	Assess potential impacts from land application
LAD Area 2					
8s and d, 9s and d, and 10s and d	Downgradient of LAD 2	s: 0 – WT plus 20 feet d: WT plus 20 feet – WT plus 50 feet	Water Levels Water Quality	Monthly	Assess potential impacts from land application
Little Cherry Creek Impoundment Site for Alternatives 2 and 4; Poorman Impoundment Site for Alternative 3					
11	Upgradient tailings impoundment	WT plus 50 feet	Water Levels Water Quality	Monthly	Background data
12 – 18	Downgradient of seepage collection system	Nested pairs – screened in surficial (if sat.) material and bedrock	Water Levels Water Quality	Monthly	Assess potential impacts from impoundment seepage
Mine and Adits					
19s and d	Adjacent to Rock Lake	s: 0 – 100 feet d: 150 – 250 feet	Water Levels	Continuous	Assess potential impact to ground water
20s and d	Adjacent to Rock Lake Fault	s: 0 – 300 feet d: 400 – 500 feet	Water Levels	Continuous	Assess potential impact to ground water
Numerous (see Figure C-3)	From within adit(s) and mine void; drilled radially in all major directions	100's to 1,000 feet from the adit/mine	Water Levels	Continuous	Monitor changes in ground water pressure as adits/mine advance

WT = water table; s = shallow; d = deep

1.5.2 Mine and Adits

Ground water monitoring for the mine and adits would include a variety of approaches, partly because much of the area above the mine and adits is in the Cabinet Mountains Wilderness (CMW) and, therefore, additional ground water monitoring wells cannot be easily installed. In addition to monitoring water level changes resulting from the mine and adit inflows, a secondary objective of the mine ground water monitoring program is to provide detailed hydraulic information from the water-bearing fractures so that a better predictive ground water model can be constructed by MMC. A three dimensional ground water model calibrated against actual head and flow information could be used to more accurately predict possible impacts to specific water bodies, such as Rock Lake, or specific springs, such as those along Rock Creek.

As the mine and adits were constructed and ground water flowed into the openings, hydraulic pressures within the fractures would change rapidly. Therefore, it would be important that ground water head data be collected prior to, and during construction along with mine inflow data early in the construction process. Once ground water levels have declined, this important data would no longer be available. As part of the Libby Adit evaluation program, MMC would extend the Libby Adit into the vicinity of the ore body (about 2,000 feet from its current terminus) and several drifts would be constructed to permit drilling from numerous underground pads to better define the ore body. Dewatering of the existing Libby Adit, extension of the adit, and construction of additional drifts and boreholes would start the dewatering process predicted for the mine void and adits. Therefore, it is essential that provisions for ground water level monitoring be established before the Libby Adit extension begins.

In addition to monitoring ground water pressure changes from underground, piezometers drilled from the surface would be installed in the vicinity of Rock Lake and the Rock Lake Fault to monitor ground water level changes over the proposed underground workings.

Different information is gathered from piezometers drilled from the surface verses those drilled from underground. Surface piezometers are important for establishing baseline or pre-construction head distributions in the aquifer and record changes as mining progresses. They are also important for monitoring rebound of the ground water system after the adit is closed and underground piezometers are no longer accessible. Underground piezometers are useful for showing the changes in head distributions around the opening and the effects of grouting. The disadvantages are that they do not record pre-construction head distributions and they are not accessible to track rebound after the mine is closed.

1.5.2.1 Piezometers Located at the Ground Surface

Ground water level monitoring can be accomplished using both surface drilled boreholes and subsurface boreholes drilled from within the adit or drifts. Because the permitting process to install monitoring wells from the surface may require considerable time, the permitting process would be started as soon as possible to ensure that the wells would be available prior to mining.

Water balance monitoring of lakes can be difficult and time consuming. The most precise method for monitoring effects to aquifers and dependent surface water features is through the use of surface piezometers. Piezometers record changes in aquifers from mining that could never be detected in surface water flow monitoring. This is because the low storage in fractured bedrock aquifers results in large changes in water level for a small perturbation in the system. Surface

piezometers are important for establishing baseline or pre-construction head distributions in the aquifer and are important for monitoring rebound of the ground water system after the adit is closed and underground piezometers are no longer accessible. Because ground water inflow and outflow is a component of the Rock Lake water balance, monitoring of the underlying, connected aquifer is essential.

Surface-based ground water monitoring would include a pair of piezometers adjacent to Rock Lake, screened at different depths (deep and shallow) for the purpose of monitoring the vertical head gradient in the saturated zone beneath the lake. Changes in the vertical gradient would indicate a mining effect to the aquifer that supports the lake water balance. The piezometers would be located close to the lake, preferably on the private land on the northeast side of the lake. Continuous recording data loggers would be installed as soon as the piezometers were completed and would be maintained during the construction, operation, and post-construction (recovery) periods. Water level measurement data would be measured at least four times per day. The data logger would be downloaded during any visit to Rock Lake to collect other monitoring data, but can be operated without downloading throughout the winter months when access is not possible.

A second pair of piezometers with a transducer and continuous recorder would be installed in the CMW uphill from Rock Lake (about 0.25 to 0.3 mile from the lake) on the east side of the Rock Lake Fault. These deep and shallow piezometers would monitor changes in ground water levels and vertical head gradients above the underground workings. Measurement and download frequencies would be the same as described for the piezometers at Rock Lake.

1.5.2.2 Underground Piezometers

Because the Libby Adit and associated drifts and boreholes would be located over a very large area partially beneath the CMW, the most efficient means for obtaining ground water level data would from within the mine voids. However, because the ability to drill from within the mine voids may be limited to about 400 feet, based on the MMC exploration program, numerous piezometers would be required (Figure C-3). The limitations to underground piezometers are that they do not record pre-construction head distributions and they are not accessible to track rebound after the mine is closed.

An array of small diameter boreholes would be installed from within the mine and adits, and instrumented with continuous recording pressure transducers. The boreholes would be drilled in a radial pattern from the mine or adits so that the degree of heterogeneity can be assessed as heads change in the fractures surrounding the adit or mine. Each drill station would consist of two boreholes, drilled approximately 30 degrees from the horizontal from adit or drift, 180 degrees apart, and a third borehole drilled vertically upward from the drift or adit (Figure C-3). The location of the piezometers for the first phase of exploratory mining is shown on Figure C-3. These locations could be modified based on the actual hydrogeological conditions encountered after review and approval by the agencies.

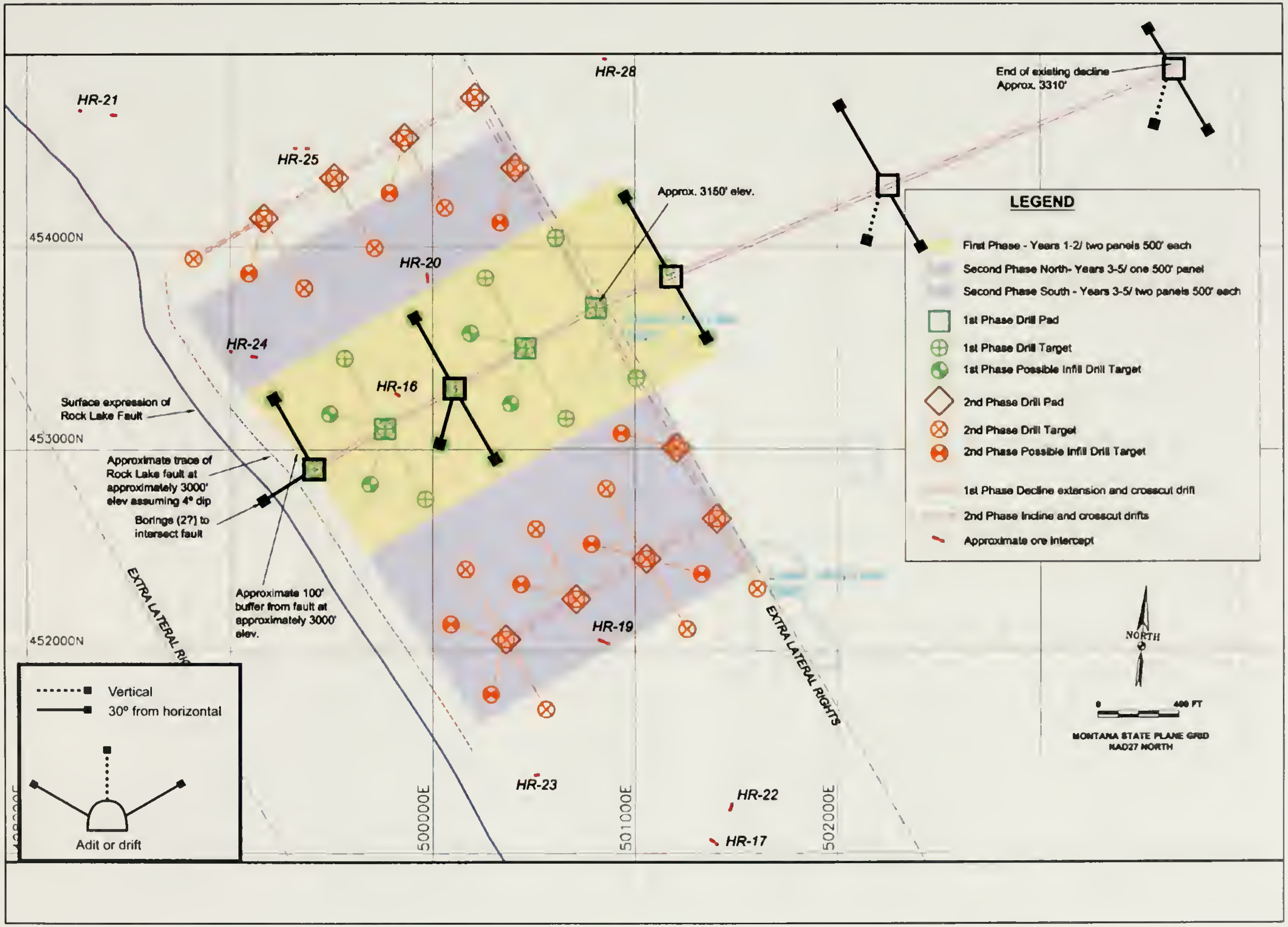


Figure C-3. Proposed Underground Piezometers

The first station would be located at the current terminus of the Libby Adit. The purpose of these piezometers is to start recording water levels as soon as possible after dewatering the existing adit. Water levels in the fractures in the surrounding rock would begin responding as soon as dewatering begins and rather than waiting until the adit is extended, these piezometers would record hydraulic response as the adit is extended with the associated dewatering. A second station on the Libby Adit would be located about half way between the current terminus and the ore body (about 1,500 feet). All subsequent monitoring stations, as shown in Figure C-3, would use planned exploration boreholes so that no additional boreholes would be required.

The underground piezometers would be constructed to permit continuous monitoring of ground water pressure at one or more intervals in each borehole. This can be accomplished by use of inflatable packers (of appropriate pressure rating) to isolate specific intervals for either the insertion of multiple transducers into a borehole or the installation of tubing that extends to the surface of the drift or adit from each interval. This approach would permit pressure monitoring of specific intervals in each borehole. At least, the deepest 25 feet would be isolated for monitoring and at least one additional zone closer to the drift or adit (for example, 100 feet from the drift or adit). Grout of sufficient length could be used to isolate zones, rather than packers, but the transducers or tubing would therefore be permanent. If packers were used, a provision to maintain their pressure at all times would be required, such as a gas cylinder and pressure regulator, and a program for regular cylinder replacement. Any borehole used for measuring ground water pressure would have to be spatially oriented and located so the information could be used for analysis.

The ground water pressure would be continuously recorded using either a transducer with a built in datalogger or with separate transducers and datalogger(s). The data would be recorded 12 times per 24 hours and would be downloaded at least quarterly to ensure proper operation of the equipment, status of battery power for the dataloggers, and to establish ground water pressure trends.

1.5.2.3 Phase II Water Level Monitoring

MMC proposes to extend drifts and install drill pads in two exploration phases: Phase I—Years 1 and 2, and Phase II—Years 3 to 5. Additional water level monitoring sites would most likely be required during Phase II. However, the location and number of sites would be determined after reviewing water level data collected during the first 2 years to evaluate the response of the ground water system to dewatering and whether the existing monitoring network density was sufficient. A plan would be developed for the additional piezometers to be installed in the remainder of the underground mine production area based on information gathered from the exploration phase.

Ground water quality is not expected to change during mine construction and operation; therefore, other than collecting additional baseline data and required samples of mine inflow water, no specific water sampling would be required. A post mining ground water sampling plan would be developed 3 to 4 years prior to mine closure. The plan would incorporate monitoring information obtained during the mining period in the design of sampling locations and sampling frequency.

1.5.3 Tailings Impoundment

In all alternatives, a seepage collection system beneath the tailings impoundment and dam would be built to minimize net seepage to ground water from the tailings impoundment. At least seven

ground water monitoring wells would be installed downgradient of the dam prior to construction of any of the facilities. At least four of these wells would be constructed as nested pairs to monitor both shallow and deeper flow paths from the impoundment. The objective of the monitoring wells is to detect and track any change in water quality or water levels due to seepage from the impoundment that was not captured by the seepage collection system. The wells would be located so that the cross-sectional area below the impoundment was adequately covered by the monitoring wells. If any preferential flow paths were encountered during the construction of the impoundment or installation of monitoring wells, they would be monitored independently. The installation of two pairs of nested wells is intended to monitor a reasonable vertical thickness of the saturated zone, given the hydrogeologic uncertainty of the area.

1.5.4 LAD Areas

MMC would install ground water monitoring wells prior to mine construction to establish pre-construction ground water conditions. If the lead agencies determine additional monitoring wells were required for land application in the tailings area, these also would be installed prior to construction activities. Monitoring wells would be located to monitor ground water quality downgradient of each LAD. Prior to operation of any LAD Area, ground water level data obtained from the new (and existing) monitoring wells would be used to construct a ground water level contour map. Additional monitoring wells would be installed if the ground water level contour map indicates that ground water downgradient of the LAD Areas was not being fully monitored by the initial set of monitoring wells.

The primary objective the of LAD Area ground water monitoring wells would be to monitor changes in water quality below the LAD Areas as an indicator of the performance of the LAD Areas. Because of the uncertainty in the expected treatment of such compounds as nitrate and ammonia by the LAD Areas, ground water quality downgradient of the LAD Areas would be used to determine the effective of LAD treatment. If nitrate or ammonia concentrations show an upward trend in ground water, MMC would undertake several sequential actions. MMC would notify the lead agencies within 2 weeks and initiate twice-a-month monitoring of all adjacent surface and ground water stations. If concentrations continued to increase and a threshold value for nitrate was exceeded in ground water downgradient of the LAD Areas, use of the LAD Areas for water disposal would cease until the nitrate concentration of the applied water was reduced by pretreatment.

The monitoring wells would be sampled quarterly for water quality parameters for 1 year after the wells were installed to establish pre-operation conditions. The wells would be sampled monthly when water was applied to the LAD Areas. Monthly sampling would continue for at least 1 year following the cessation of discharges.

At the end of the first monitoring year and following submittal of the annual report, MMC would meet with the lead agencies to discuss the monitoring results and evaluate the effectiveness of the land application treatment system. Following the annual review, the lead agencies would decide whether a change in monitoring or operations would be required. MMC would present the details of additional monitoring in the final water management/treatment plan to be submitted to the lead agencies for review and approval.

1.5.5 Mine Water

Ground water would be produced from the adits and mine void during the construction and mining periods. Inflow rates would vary as new fractures were encountered and drained but a steady state inflow of several hundred gallons per minute is expected. MMC intends to use water generated from the mine and adits in the mill circuit as makeup water. Currently, the MPDES permit at the Libby Adit that stipulates monitoring activities for mine water discharged via these approved outfalls. MMC would follow those permit monitoring requirements. Table C-8 shows the constituents and detection levels currently in place. Antimony, barium, beryllium, nickel, selenium, and thallium would be analyzed during the initial production year.

Water samples would be collected at the yard run-off pond. Adit and mine water would be "composited" on an hourly basis over a 24-hour period for all constituents except nitrate. Samples collected for nitrate analysis would be collected on a discreet basis because composite samples collected over 24 hours would likely exceed the 48-hour holding time for nitrate plus nitrite as N before the sample can be analyzed.

1.5.5.1 Process Water

Process water in the tailings impoundment would be sampled at the same time as the surface water sample collection frequency and following the constituent list developed for surface and ground water analyses. Seepage water collected by the underdrain system reporting to the Seepage Collection Pond and pumped back to the tailings impoundment would be sampled at the same frequency as the surface water samples and analyzed for the same parameter list.

1.5.6 Sample Frequency

Sampling from the yard run-off pond would be monthly or as specified in the MPDES permit when mine water was held in this facility. Other samples would be of sufficient frequency to determine actual average concentrations of the constituents shown in Table C-8, as determined by the DEQ.

Mine discreet samples during the first 6 months of construction would be collected and analyzed for nitrate plus nitrite as N and ammonia as N twice per month. During the next 6 months, sampling and analysis would alternate every month between every other day and twice a month.

If substantial inflows to the mine occur in the vicinity of Rock and St. Paul Lakes, MMC would report inflows to the lead agencies within 48 hours. Lake level data would be recorded continuously and included in regular reporting documents. Mine inflows would be sampled at the same frequency as the surface water samples and follow the same constituent list.

Table C-8. Proposed Monitoring Parameters and Detection Limits for Ground Water and Mine and Tailings Water.

Parameter (Non-metals)	Detection Limit (mg/L unless otherwise designated)	Parameter (Dissolved Metals)	Detection Limit (mg/L)
pHs.u.)	0.1	Aluminum	0.03
Dissolved Oxygen	0.1	*Antimony	0.003
Specific Conductivity (µS/cm)	1.0	Arsenic	0.001
Total dissolved solids	1.0	*Barium	0.005
Sodium	1.0	*Beryllium	0.001
Calcium	1.0	Cadmium	0.0001
Magnesium	1.0	Chromium	0.001
Potassium	1.0	Copper	0.001
Carbonate	1.0	Iron	0.01
Bicarbonate	1.0	Lead	0.003
Chloride	1.0	Manganese	0.005
Sulfate	1.0	Mercury	0.0001
Nitrate+Nitrite, as N	0.01	*Nickel	0.01
TKN	0.1	*Selenium	0.001
Total Phosphorus as P	0.005	Silver	0.003
Ortho-phosphate	0.005	*Thallium	0.001
Ammonia, as N	0.05	Zinc	0.001
Field Temperature			
Total Alkalinity (as $CaCO_3$)	1.0		
Total Hardness (as $CaCO_3$)	1.0		
Acrylamide†	0.01 or lowest possible		

*Mine and tailings water would be analyzed for antimony, barium, beryllium, nickel, selenium, and thallium in the first year of operations.
†In tailings impoundment water and ground water downgradient of the tailings impoundment.

1.5.6.1 Water Balance

MMC would maintain a water balance as part of the water resources monitoring effort. The detailed water balance would include inflows and outflows to the project facilities. The monitoring information would be used to modify, as necessary, operational water handling and to develop a post-mining water management plan. As part of this monitoring, MMC would measure:

- Daily mine and adit discharges
- The amount of tailings (coarse and fine) slurried to the impoundment and the percent solids of the slurry
- The amount and source of fresh makeup water used by the mill
- The amount of reclaimed process water (tailings impoundment) sent to the mill

- The amount of water collected by the seepage underdrain collections system and pumped back to the impoundment
- The amount and source of water sent to the dust suppression systems, if any
- The amount and source of water discharged to the LAD Areas, if any
- The amount and source of water discharged through the Libby Adit MPDES discharge permit
- Pan evaporation at impoundment site
- Evapotranspiration at the LAD Areas
- The amount of precipitation received at the tailings impoundment site and LAD Areas.

These measurements would be provided as monthly (or more frequently if requested by the lead agencies) and annual averages and totals in a quarterly hydrology report. If mine adit inflows greater than 1,200 gpm occur over a 2-month period or excessive tailings water occurs or was anticipated, MMC would notify the lead agencies within 2 weeks. MMC would then implement "excess water contingency plans." If the mine void encounters substantial ground water inflows in the vicinity of the Rock Lake Fault, MMC must notify the lead agencies within 10 business days and then must evaluate the possible connection to surface water bodies and provide an evaluation report to the lead agencies within 90 days after initial agency notification.

1.6 Plan Management

1.6.1 Quality Assurance/Quality Control

As part of each plan for environmental monitoring, MMC would develop quality assurance/quality control (QA/QC) procedures and submit them to the agencies for review and approval. Collectively, these procedures would compose a QA/QC plan that ensures the reliability and accuracy of monitoring information as it was acquired. QA/QC procedures would include both internal and external elements. Internal elements may include procedures for redundant sampling such as random blind splits or other replication schemes, chain of custody documentation, data logging, and error checking. External procedures may include audits and data analyses by outside specialists, and oversight monitoring and data checking conducted by the agencies.

Written reports to document the implementation of the QA/QC plan would be an integral part of monitoring reports. Any variances or exceptions to established sampling or data acquisition methods were detected during monitoring must be documented. Documentation would include a discussion of the significance of data omissions or errors, and measures taken to prevent any occurrences. Reports would be submitted to the appropriate agencies with the annual report, unless otherwise requested.

1.6.2 Sample Collection and Data Handling

Collection, storage and preservation of water samples would be in accordance with EPA procedures (EPA 1982). Grab samples would be collected from streams and ground water samples would be obtained using low flow sampling techniques. Samples would be cooled immediately after collection. Metals in water samples must be preserved by adding nitric acid in

the field to lower the pH to less than 2.0 or as appropriate to meet standard industry sampling protocols.

Ground water samples for metal analyses would be field filtered through a 0.45 micron filter to allow measurement of the dissolved constituents. Chemical analysis of water samples must be by procedures described in 40 CFR 136, EPA-0600/4-79-020, or methods shown to be equivalent. All field procedures must follow standard sampling protocols as demonstrated through the quality assurance and quality control documentation.

MMC would use a sample control plan, which includes sample identification protocol, the use of standardized field forms to record all field data and activities, and the use of chain-of-custody, sample tracking and analysis request forms. MMC would develop a master file of all field forms and laboratory correspondence. MMC would meet the laboratory method-required holding time for each constituent being analyzed.

MMC would ensure representativeness of samples collected by locating sampling stations in representative areas and by providing quality control samples and analyses. Quality control samples must include blind field standards, field cross-contamination blanks, and replicate samples. Field cross-contamination blanks would be inserted at a minimum frequency of 1 in 20. Blind field standards and field replicates would be inserted into the sample train at a minimum frequency of 1 in 20. In addition, MMC would use EPA-approved laboratories. If revised sampling methods or QA/QC protocols change, MMC would incorporate those as directed by the lead agencies.

1.6.3 Water Resource Data Reporting

Data (water quality and flow measurements) would be submitted to the reviewing agencies by MMC within 10 working days after receipt of final laboratory results. All monitoring data would be submitted to the lead agencies in an electronic format acceptable to the lead agencies. MMC would prepare a report briefly summarizing hydrologic information, sample analysis and quality assurance/quality control procedures following each sample interval. The report would be posted on MMC's website within 4 weeks after receipt of final laboratory results.

The annual report, summarizing data over the year, would include data tabulations, maps, cross-sections and diagram needed to describe hydrological conditions. Raw lab reports and field and lab quality results also would be reported. In the annual report, MMC would present a detailed evaluation of the data. Data would be analyzed using routine statistical analysis, such as analysis of variance, to determine if differences exist

- Between sampling stations
- Between an upstream reference station and the corresponding downstream station
- Between sampling time (monthly, growing season/non-growing season)
- Between stream flow at the time of sampling (for example, low flow during the fall compared to low flow during the winter)
- Between sampling years
- Trend analyses would be included where applicable and/or quantifiable.

The annual report would be posted on MMC's website within 90 days after receipt of the final laboratory results for the final quarter of the year. A formal review meeting would be arranged within 2 weeks of MMC submitting the monitoring report to the lead agencies. The formal review meeting would involve representatives from the reviewing agencies and MMC. The review could result in various outcomes:

- Determine that no change in the monitoring programs or mine operation plans was needed
- Require modifications to the monitoring programs
- Require new treatment or mitigation measures to be implemented as part of the mine project
- Require MMC to implement necessary measures to ensure compliance with applicable laws and regulations

2.0 Aquatic Biological Monitoring

2.1 General Requirements

MMC would conduct aquatic biological monitoring using locations, timing, and methods that are updated and expanded from those specified in Operating Permit 00150 and the 1993 KNF ROD. The modifications to the monitoring requirements would improve the ability to detect potential impacts of the project and meet all stream biology monitoring requirements for the full project.

MMC would conduct aquatic biological monitoring before, during, and after project construction and operation at stream stations that are within and downstream of project disturbance boundaries and at reference stations that are upstream of potential influence from the project. At replicate sample locations within each station, multiple parameters that are likely to display small-scale variability and likely to be correlated would be assessed. Replicated sample locations would be selected to be as similar as possible across stations. This sampling design would allow analysis of data using a before-after/control-impact approach, and would allow use of univariate and multivariate statistical methods. This sampling design is intended to identify natural variability and isolate the influence of water quality and fine sediment deposition on stream biota and habitat.

MMC would collect surface water quality samples at each aquatic biological monitoring station during each monitoring period to assist in interpretation of the data. MMC would also conduct salmonid population surveys and salmonid tissue chemistry surveys to provide additional information to assess the influence of the project on stream biota.

2.2 Monitoring Locations and Times

Depending on the alternative that is selected, MMC would conduct aquatic biological monitoring at up to 15 stations (Table C-9 (at the end of this document), Figure C-4). Ten stations are within or downstream of the proposed disturbance boundaries. Five stations, one for each stream in the project area, are upstream of potential project impacts and would serve as reference stations. Additional monitoring stations would be established in Rock Creek and East Fork Bull River if it is determined that the project has influenced water quality in these streams.

Monitoring frequency would vary, depending on the monitoring task and station (Table C-10). Most tasks would be conducted three times annually: prior to run-off from the higher elevations in the spring (typically April or May), during late-summer low flows (typically mid July to late August), and prior to ice formation (typically October). Other tasks would be conducted annually during the late-summer period, or less frequently as described below.

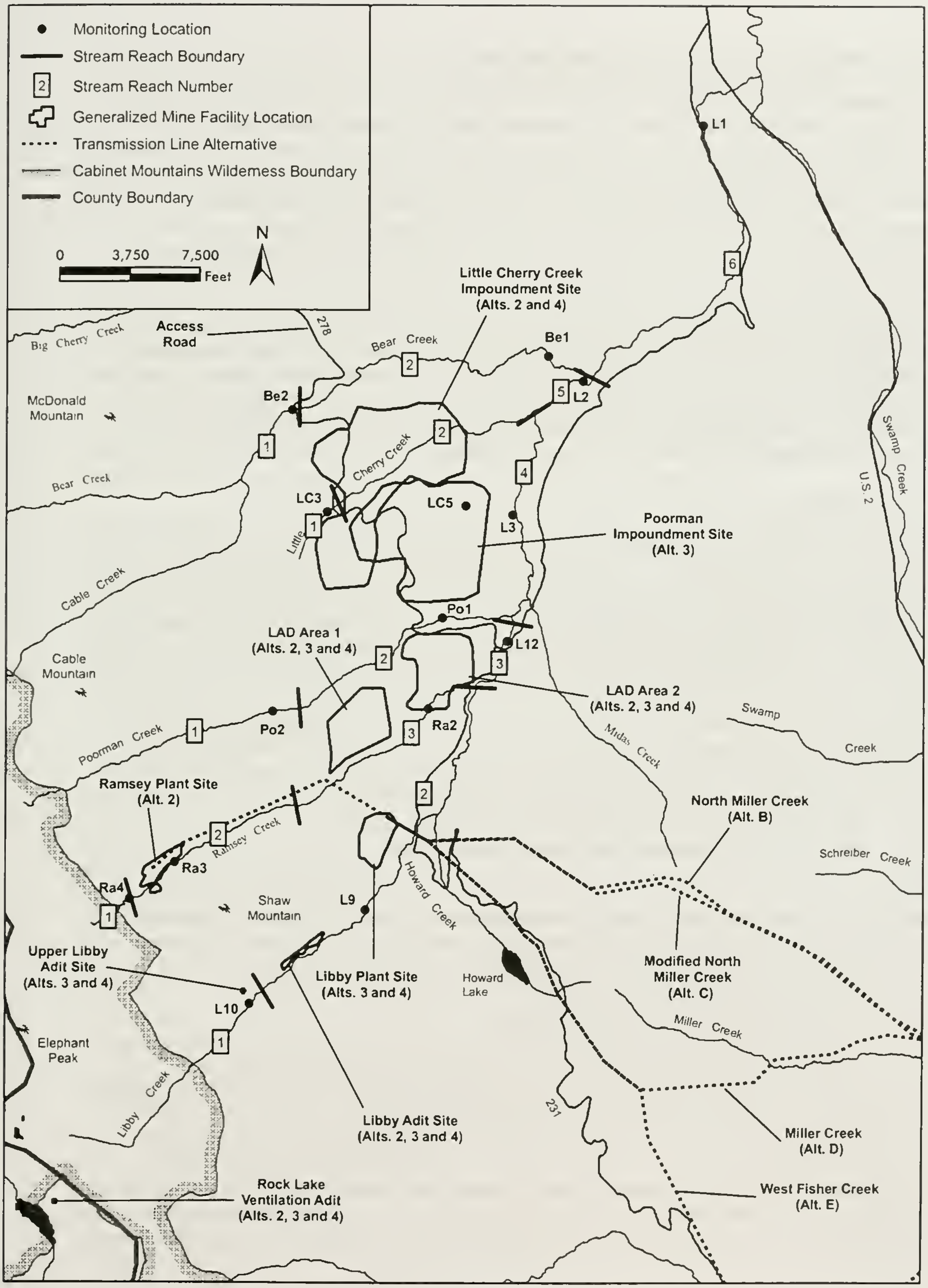


Figure C-4. Proposed Aquatic Biology Monitoring Locations

2.3 Substrate and Fine Sediments

MMC would document substrate characteristics and estimate fine sediment loading at all aquatic biological monitoring stations during all monitoring periods. Percent surface fines would be visually estimated using a grid sampling device as described in the R1/R4 methodology (Overton et al. 1997) at each quantitative macroinvertebrate sample (Surber sample) location. Embeddedness would be visually estimated at each Surber sample location using an embeddedness rating description (Platts et al. 1983). Substrate size distributions would be determined by conducting Wolman pebble counts of the substrate within each Surber sample (Wolman 1954).

At the five fish monitoring stations (L1, L3, L9, New LC5, and Be2, see below), the substrate monitoring methods described above would be supplemented with the McNeil Core substrate sampling method (based on Weaver and Fraley 1991). Ten representative core samples would be collected from potential spawning locations in scour pool tail crests and low-gradient riffles within the salmonid population survey reach at each of the four stations. Fewer core samples would be collected if 10 suitable locations are not located within the survey reach.

2.4 Habitat

Habitat surveys would be conducted annually in the late-summer concurrent with the fish monitoring surveys at Stations L1, L3, L9, New LC5, and Be2. Fish structures developed as mitigation also would be monitored. Instream habitat data collection would generally follow the R1/R4 methods developed by the FS (Overton et al. 1997). Habitat types within the stream reaches would be identified and measured individually. Measurements at recognized units within each habitat type would include length, wetted width, bank width, average depth, maximum depth, substrate type, type of bank vegetation, percent undercut bank, and percent eroded bank. These habitat measurements are consistent with the Inland Native Fish Strategy (INFS) goals. Additionally, other measurements, such as pool frequency, number of pieces of large woody debris, and lower bank angle, would be recorded to document further attainment of the riparian management objectives set by INFS (USDA Forest Service 1995).

2.5 Routine Physical/Chemical Features

MMC would measure the following routine physical and chemical parameters at all aquatic biological monitoring stations during all monitoring periods: stream discharge, air and water temperature, pH, total alkalinity, specific conductance, and sulfate. EPA approved methods or other acceptable methods specified in the monitoring plan would be used.

2.6 Benthic Macroinvertebrates

MMC would collect five quantitative samples and one qualitative sample of benthic macroinvertebrates from all aquatic biological monitoring stations during all monitoring periods. Methods used would generally follow the guidelines described in the DEQ's macroinvertebrate sampling protocol (2006) for the collection of quantitative Hess samples and semi-quantitative jab samples. Quantitative samples would be collected using a 500-micrometer mesh Surber sampler rather than a Hess net because Surber samplers have been used by the FWP in Libby Creek beginning in 2000 (Dunnigan et al. 2004. The continued use of the Surber sampler thus would allow for better comparisons with past data. Quantitative samples would be collected from

the riffle/run habitats in the stream. Specific sampling locations at each station would be standardized, to the extent possible, for depths between 0.5 and 1.0 feet and flow velocities of less than 1.5 feet per second. MMC would collect the qualitative jab sample with a 500-micrometer mesh kicknet in all micro-habitats not sampled during the collection of the quantitative samples, such as aquatic vegetation, snags, and bank margins. Benthic macroinvertebrates collected with the kicknet would be used to provide supplemental information on species composition at the sites and to determine the relative abundance of the taxa inhabiting aquatic habitats at the sampling station.

Parameters analyzed would include density, number of taxa, number of *Ephemeroptera*, *Plecoptera*, and *Trichoptera* (EPT) taxa, the EPT index, percent EPT individuals, Shannon-Weaver diversity index, Simpson diversity index, and the biotic condition index (BCI). Several of these parameters are among the metrics calculated by the DEQ as part of its data analysis (DEQ 1995; 2006), The use of other metrics such as evenness, Simpson's diversity index, and the BCI have been recommended by FS personnel to allow for comparisons with previously collected data within this region (Steve Wegner, personal communication, 2006). To summarize these data, four common statistical measures would be used (mean, standard deviation, coefficient of variation, and standard error of the mean), plus other appropriate measures (EPA 1990).

Quality assurance for macroinvertebrate data would be conducted randomly on 10 percent of the samples, with 95 percent agreement for taxonomic and count precision required. MMC also would maintain a permanent taxonomic reference collection that contains all benthic species collected from project area streams. Taxa identification in this collection would be documented and confirmed by a second taxonomist. This reference collection would be maintained by MMC through the period of post-operational monitoring. Following this period, the collection would be transferred to a depository selected by the agencies for permanent scientific reference.

2.7 Chlorophyll-a

MMC would sample periphyton at all aquatic biological monitoring stations concurrent with the proposed benthic macroinvertebrate population sampling. At each station, sample design, collection and analysis would follow DEQ's chlorophyll-a sampling protocol (2008). For diatoms, permanent slide mounts would be prepared. .MMC would prepare data reports that include lists of all taxa identified.

To provide quality control and quality assurance for these studies, MMC would maintain a permanent reference collection that contains representative samples of all dominant and any indicator taxa of periphyton collected from the monitoring stations. All such non-diatom taxa would be documented using digital photography and representative permanent slide mounts made for diatom taxa. Taxonomic identifications in the reference collection would be confirmed by a second taxonomist. This reference collection would be maintained by MMC through the period of post-operational monitoring. Following this period, the collection would be transferred to a depository selected by the agencies for a permanent scientific reference.

2.8 Salmonid Populations

To determine possible changes in salmonid populations associated with development of the Montanore Project, MMC would monitor salmonid populations in Libby Creek and Bear Creek annually during the late-summer sampling period. Salmonid population monitoring would be

conducted if the required permits were granted to MMC. If the required permits were not granted for some or all of the salmonid population monitoring, MMC would report the most relevant data that are available for the project area.

MMC would monitor salmonid populations in Libby Creek in three stream reaches (L1, L3, L9), the diverted Little Cherry Creek (new LC5), and Bear Creek (Be2) using the following procedures. The stream reach would be blocked by netting at its upstream and downstream limits to prevent fish movement into or out of the sample reach during the sampling. Sampling procedures would include multiple-pass depletion electroshocking to collect salmonids from a 300-yard (or 300-meter) reach of stream. All salmonids would be identified, measured for length, and released. Population densities of each salmonid species captured during the study would be estimated, where adequate sample sizes permit, using a maximum-likelihood model (e.g. Seber and Le Cren 1967, MicroFish 3.0). The condition of all captured salmonids would be recorded following an examination for overt signs of disease, parasites, or other indications of surface damage. Length-frequency data would be analyzed to determine whether species were naturally reproducing in or near the stream reaches. A monitoring report would be submitted annually to the KNF, the FWP and the DEQ.

The same salmonid monitoring procedures would be used to monitor salmonid response to fish mitigation projects implemented by MMC. Beginning in the year prior to a fish mitigation project, salmonid population density and biomass would be estimated using the approved methods. In subsequent years (yearly), the mitigation monitoring at each site would be repeated until there was evidence of a stable increase in salmonid populations at each site. The salmonid population data from stations L1 and Be2 would be used as controls to assess if observed changes were a natural event. Five consecutive years of data showing a positive response by salmonids would be required before MMC was credited for a mitigation project.

Similarly, MMC would monitor the recreational use levels at all fishery access sites that were modified for mitigation purposes. Beginning the year before, and extending at least 5 years after implementation, MMC would conduct creel surveys to show a stable increase in use by the targeted users of each access project.

2.9 Bioaccumulation of Metals in Fish Tissue

MMC would conduct monitoring studies that measure background concentrations of copper, cadmium, mercury, and lead in the fish in Libby Creek to provide a basis for comparison in order to document any potential changes in the concentrations of these metals due to construction and operation of the Montanore mine. Fish tissue monitoring would be conducted if the required permits were granted to MMC. If the required permits were not granted for some or all of the fish tissue monitoring, MMC would report the most relevant data that are available for the project area.

Prior to construction and once construction has begun, MMC would collect five rainbow trout or rainbow trout hybrids (*Oncorhynchus* sp.) annually from Sites L1, L3, and Be2 for a period of 5 years, with each trout collected being greater than 4 inches in size. Collections would be completed during the late-summer low-flow period, concurrent with the fish population surveys.

Homogenized whole-fish tissue samples would be analyzed to determine copper, cadmium, mercury and lead concentrations. Thereafter, if no increasing trends in metal concentrations have

been identified, MMC would resample each site at a 3-year interval to document any trends in bioaccumulation of these metals. Test procedures would be the same as those used for baseline testing, unless changed by the agencies.

2.10 Sampling Trip and Annual Reporting

Within one week of completing biological sampling, MMC would submit a brief report to appropriate review personnel in the DEQ, the KNF, and the FWP. This report would include brief statements about stream conditions observed at each monitoring station and would alert the review personnel to any marked changes in monitoring data relative to the cumulative monitoring record.

On or before March 1 of each year, MMC would submit an annual aquatic monitoring report that contains summaries of all aquatic monitoring data collected during the previous year. Each report also would discuss trends in population patterns and evaluate changes in stream habitat quality, based on all data collected to date for the project. Reference to appropriate scientific literature would be included. Recommendations in these reports can include modifications to increase monitoring efficiency or to provide additional data needs.

2.11 Annual Review and Possible Revision of the Monitoring Plan

Within one month after MMC submits the annual report, an annual meeting would be held to review the aquatics monitoring plan and results, and to evaluate possible modifications to the plan. This meeting would include personnel from the DEQ, KNF, FWP, MMC's representatives, and other interested individuals.

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Table C-9. Aquatic Biology Monitoring Stations.

Reach	Nearest Upstream Activities	Station ID (surface water ID)	Station Comments	Alter-native	All non-fish monitoring, spring, late-summer, fall	Fish population and habitat, late-summer	Fish tissue metals, late-summer
			Ramsey Creek				
1	none	Ra4 (RA-100)	Upstream reference	2	X		
2	Ramsey Plant Site and Adits, tailings lines, bridge and transmission line	Ra3 (RA-200)	Impact assessment for activities in upper Ramsey Creek. The nearest suitable habitat downstream of of the upper Ramsey Creek disturbance boundary would be monitored.	2	X		
3	LAD 1 and 2, tailings line, access raod	Ra2 (RA-550)	Integrated impact assessment for activities in upper and lower Ramsey Creek.	All	X		
			Poorman Creek				
1	none	Po2 (PM-500)	Upstream reference	All	X		
2	LAD 1 and 2, tailings line and road	Po1 (PM-1000)	Impact assessment. Po1 located downstream of the FS 6212 bridge.	All	X		
			Little Cherry Creek/Former Little Cherry Creek				
1	none	LC3 (LC-100)	Upstream reference; site would be upstream of NFS road #278	2 and 4	X		
2	Tailings Impoundment facilities	LC1 (LC-800)	Impact assessment	2 and 4	X		
	Tailings Impoundment facilities	New LC5	Impact assessment. Site would be in suitable habitat in Diversion Channel	2 and 4	X	X	X

Reach	Nearest Upstream Activities	Station ID (surface water ID)	Station Comments	Alter-native	All non-fish monitoring, spring, late-summer, fall	Fish population and habitat, late-summer	Fish tissue metals, late-summer
			Bear Creek				
1	none	Bc2 (BC-500)	Upstream reference	2	X	X	X
2	Impoundment surface runoff	Bc1 (BC - 100)	Impact assessment at closure only	2	X		
			Libby Creek				
1	none	L10 (LB-200)	Upstream reference; upstream of Upper Libby Adit	All	X		
2	Libby Adit facilities	L9 (LB-300)	Impact assessment	All	X	X	
3	LAD 2	L12	Integrated impact assessment	All	X		
4	LAD 2	L3 (LB1000)	Integrated impact assessment	All	X	X	X
5	Impoundment	L2 (LB-2000)	Integrated impact assessment	All	X		
6	All	L1 (LB-3000)	Integrated impact assessment	All	X	X	X

Table C-10. Aquatic Biology Monitoring Tasks.

Task category	Task	Timing			Number of stations	Method	Replication per station and within-station locations
		Spring	Late-summer	Fall			
Benthic Biota	Macroinvertebrates, quantitative	X	X	X	all	Surber samples for lab taxonomy	5 sites with most similar microhabitat near station
	Macroinvertebrates, qualitative	X	X	X	all	kicknet sample for lab taxonomy	1 sample from all habitats in 100 ft reach that includes Surber sample locations
	Periphyton, quantitative	X	X	X	all	biomass samples for spectrophotometric determination	at each of the 5 Surber sites
	Periphyton, qualitative	X	X	X	all	picking and scraping all varieties for lab taxonomy	In accordance with DEQ SOP
Habitat	Canopy cover	X	X	X	all	densiometer	at each of the 5 Surber sites
	Water velocity	X	X	X	all	flow meter at 0.6 m depth	at each of the 5 Surber sites
	Stream discharge	X	X	X	all	velocity-area principle / 0.6 m depth	1 transect at station
	Fish habitat survey		X		4	R1/R4	same 100 yd reach as salmonid survey
Substrate	Embeddedness	X	X	X	all	visual categorical scale	at each of the 5 Surber sites
	Substrate size distribution	X	X	X	all	Wolman count	surrounding and including each of the 5 Surber sites
	Surface fines	X	X	X	all	49 point grid	at each of the 5 Surber sites
	Spawning gravel		X		4	McNeil cores for lab analysis and field settling cone	maximum obtainable up to 10 samples within 100 yd salmonid survey reach
Water Quality	Conductivity	X	X	X	all	meter	at each of the 5 Surber sites
	pH	X	X	X	all	meter	at each of the 5 Surber sites
	Water temperature	X	X	X	all	meter	at each of the 5 Surber sites
	Water chemistry sample	X	X	X	all	grab sample for comprehensive lab analysis	1 sample at station
Fish	Salmonid population survey		X		4	multiple-pass electrofishing	extending from station to 100 yd upstream
	Salmonid tissue metals samples		X		3	*Oncorhynchus* sp. whole-fish Cu, Cd, Hg, Pb	5 fish from population survey

Appendix D—Proposed Environmental Specifications for the 230-kV Transmission Line

STATE OF MONTANA/USDA FOREST SERVICE
ENVIRONMENTAL SPECIFICATIONS FOR MONTANORE 230-KV TRANSMISSION LINE

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DEFINITIONS

ACCESS EASEMENT:	Any land area over which the OWNER has received an easement from a LANDOWNER allowing travel to and from the project. Access easements may or may not include access roads.
ACCESS ROAD:	Any travel course which is constructed by substantial recontouring of land and which is intended to permit passage by most four-wheeled vehicles.
ARM:	Administrative Riles of Montana
BEGINNING OF CONSTRUCTION:	Any project-related earthmoving or removal of vegetation (except for clearing of survey lines).
BOARD:	Montana Board of Environmental Review
CFR	Code of Federal Regulations
CONTRACTOR:	Constructors of the Facility (agent of owner)
DAY	Monday through Friday, excluding all state or federal holidays
DEQ:	Montana Department of Environmental Quality
DNRC:	Montana Department of Natural Resources and Conservation
FWP:	Montana Fish, Wildlife, and Parks
EXEMPT FACILITY:	A facility meeting the requirements of 75-20-202, MCA and accompanying rules.
FS:	United States Department of Agriculture, Forest Service
KNF:	Kootenai National Forest
LANDOWNER:	The owner of private property
MCA	Montana Code Annotated
MDT	Montana Department of Transportation
NFSL:	National Forest System Lands
OWNER:	The owner(s) of the facility, or the owner's agent.

ROD:	Record of Decision
SENSITIVE AREA:	Area which exhibits environmental characteristics that may make them susceptible to impact from construction of a transmission facility. The extent of these areas is defined for each project and may include any of the areas listed in Circular MFSA-2, Sections 3.2(1)(d) and 3.4(1).
SHPO:	State Historic Preservation Office
SPECIAL USE SITES:	All locations other than structure locations and roads needed for the construction, operation, and decommissioning of the transmission line, and shall include, but not be limited to, staging areas, helicopter landing and fueling sites, pulling and tensioning sites, stockpile sites, splicing sites, borrow pits, construction campsites, and storage or other building sites.

INTRODUCTION

The purpose of these specifications is to ensure mitigation of potential environmental impacts during the construction and interim reclamation of the 230-kV transmission facility associated with the proposed Montanore Project. These specifications do not apply to the Sedlak Park substation, loop line, buried 34.5-kV powerline associated with the Montanore Mine, or to the mine itself. All other mine-related disturbances are covered by a Montana Department of Environmental Quality (DEQ) hard rock operating permit and Forest Service (FS) Plan of Operations. These specifications vary from those typically prepared by DEQ for other transmission line facilities because the specifications also incorporate FS requirements. These specifications are intended to be incorporated into the texts of contracts, plans, Plan of Operations, and specifications.

Decommissioning of the transmission line will be covered by the final reclamation and closure plan described in Appendix at the end of this document.

For non-exempt facilities, the Montana Major Facility Siting Act supersedes all state and local government environmental permit requirements. DEQ, however, returns the authority to determine compliance of the proposal facility with state and federal standards for air and water quality standards. State laws for the protection of employees engaged in the construction, operation on maintenance of the proposal facility also remain in effect (Section 75-20-401, MCA).

Appendices at the end of these specifications refer to individual topics of concern and to site-specific concerns. Certain of these Appendices, will be prepared by the OWNER working in consultation with DEQ and FS prior to the start of construction and submitted for approval by the DEQ and FS. Other Appendices will be prepared by the DEQ and FS at the time a decision is made whether to approve the project.

GENERAL SPECIFICATIONS

0.1. SCOPE

These specifications apply to all lands affected by the 230-kV transmission line, excluding the Sedlak Substation and loop line and the 34.5-kV power line. As provided in ARM 17.20.1902 (10), the certificate holder may contract with the property owner for revegetation or reclamation if the property owner wants different reclamation standards from (10) (a) applied on the property and that not reclaiming to the standards specified in (10)(a) and (b) would not have adverse impacts on the public and other landowners. Where the LANDOWNER requests practices other than those listed in these specifications, DEQ may authorize such a change provided that the STATE INSPECTOR is notified in writing of the change and that the change will not be in violation of: (1) the Certificate; (2) any conditions imposed by the DEQ or (3) the DEQ's finding of minimum adverse impact; (4) the regulations in ARM 17.20.1701 through 17.20.1706, 17.20.1901, and 17.20.1902.

On private land, these specifications shall be enforced by the STATE INSPECTOR. On NFSL, enforcement shall be the joint responsibility of the STATE INSPECTOR and the KNF INSPECTOR.

0.2. ENVIRONMENTAL PROTECTION

The OWNER shall conduct all operations in a manner to protect the quality of the environment.

0.3. CONTRACT DOCUMENTS

It is the OWNER'S responsibility to ensure compliance with these specifications. If appropriate, these specifications can be part of or incorporated into contract documents to ensure compliance; in any case, the OWNER is responsible for its agent's adherence to these specifications in performing the work.

0.4. BRIEFING OF EMPLOYEES

The OWNER shall ensure that the CONTRACTOR and all field supervisors are provided with a copy of these specifications and informed of the applicability of individual sections to specific procedures. It is the responsibility of the OWNER to ensure its CONTRACTOR and CONTRACTOR's Construction Supervisors comply with these measures. The OWNER'S Project Supervisor shall ensure all employees are informed of the applicable environmental specifications discussed herein prior to and during construction. Site-specific measures provided in the appendices attached hereto shall be incorporated into the design and construction specifications or other appropriate contract document. The OWNER shall have regular contact and site supervision to ensure compliance is maintained.

0.5. COMPLIANCE WITH REGULATIONS

All project-related activities of the OWNER shall comply with all applicable local, state, and federal laws, regulations, and requirements that are not superseded by the Major Facility Siting Act.

0.6. LIMITS OF LIABILITY

The OWNER is not responsible for correction of environmental damage or destruction of property caused by negligent acts of DEQ or FS employees during construction, operation maintenance, decommissioning, and reclamation of the proposal project.

0.7. DESIGNATION OF SENSITIVE AREAS

DEQ and FS, in their evaluation of the transmission line, have designated certain areas along the right-of-way or access roads as SENSITIVE AREAS as indicated in Appendix A. The OWNER shall take all reasonable actions including the measures listed in Appendix Ato avoid adverse impacts in these SENSITIVE AREAS.

0.8. PERFORMANCE BONDS

To ensure compliance with these specifications, prior to any ground disturbing activity, the OWNER shall submit a BOND ("TRANSMISSION LINE CONSTRUCTION AND RECLAMATION BOND") to the State of Montana or its authorized agent pertaining specifically to the reclamation of designated access roads, special use areas, and adjacent land disturbed during construction (Appendix B). The TRANSMISSION LINE CONSTRUCTION AND RECLAMATION BOND shall be held to ensure cleanup and construction reclamation are complete and revegetation is proceeding satisfactory. At the time cleanup and construction reclamation are complete and revegetation is proceeding satisfactory, the OWNER shall be released from its obligation for transmission line construction reclamation and the TRANSMISSION LINE CONSTRUCTION AND RECLAMATION BOND shall be released.

Concurrently, the OWNER shall submit a separate BOND ("JOINT DECOMMISSIONING BOND") to the DEQ and FS pertaining specifically to monitoring, decommissioning of the transmission line and reclamation follow decommissioning. The JOINT DECOMMISSIONING BOND shall be subject to the FS and DEQ bond release provisions as outlined in the Reclamation Plan approved by the FS and DEQ. The approved Reclamation Plan shall contain reclamation standards as stringent as those found in ARM 17.20.1902(10).

0.9. DESIGNATION OF STRUCTURES

Each structure for the transmission line shall be designated by a unique number on plan and profile maps and referenced consistently. Any reference to specific poles or structures in the Appendices shall use these numbers. If this information is not available because the survey is not complete, station numbers or mileposts shall indicate locations along the centerline. Station numbers or mileposts of all angle points shall be designated on plan and profile maps.

0.10. ACCESS

When easements for construction access are obtained for construction personnel, provision shall be made by the OWNER to ensure that DEQ will be allowed access to the special use areas, right-of-way, and to any off-right-of-way access roads. Where such easements are obtained on private land to provide access to NFSL, such provisions shall also be made for the KNF INSPECTOR. Liability for damage caused by providing such access for the STATE INSPECTOR or KNF INSPECTOR shall be limited by section 0.6 LIMITS OF LIABILITY.

0.11. DESIGNATION OF STATE INSPECTOR AND KNF INSPECTOR

DEQ shall designate a STATE INSPECTOR or INSPECTORS to monitor the OWNER'S compliance with these specifications and any other project–specific mitigation measures adopted by DEQ as provided in ARM 17.20.1901 through 17.20.1902. The FS shall designate a KNF INSPECTOR or INSPECTORS to monitor the OWNER'S compliance with the Plan of Operations for activities on NFSL. The STATE INSPECTOR shall be the OWNER's liaison with the State of Montana on construction, post-construction, and construction reclamation activities for the certified transmission line on all state and private lands. The KNF INSPECTOR and the STATE INSPECTOR shall coordinate lead roles for construction, post-construction, and reclamation activities for the certified transmission line on NFSL. All communications regarding the project shall be directed to the STATE INSPECTOR and on NFSL, to the KNF INSPECTOR and STATE INSPECTOR. The names of the INSPECTORS are in Appendix C.

1.0. PRECONSTRUCTION PLANNING AND COORDINATION

1.1. PLANNING

1.1.1. Planning of all stages of construction and maintenance activities is essential to ensure that construction-related impacts shall be kept to a minimum. The CONTRACTOR and OWNER shall, to the extent possible, plan the timing of construction, construction and maintenance access requirements, location of special use areas, and other details before the commencement of construction.

1.1.2. At least 45 days before the start of construction, the OWNER shall submit plan and profile map(s), both on paper and an electronic equivalent agreed to by the DEQ and FS, to DEQ and the FS depicting the location of the centerline and of all construction access roads, maintenance access roads, structures, clearing back lines, and, to the extent known, special use sites. The scale of the map shall be 1:24,000 or larger. Specifications and typical sections for construction and maintenance access roads shall be submitted with the plan and profile maps(s). When these materials are submitted, access road locations shall have been flagged on the ground for review by the KNF and STATE INSPECTORS.

1.1.3. At least 45 days before the start of construction, constructing or reconstructing roads, the OWNER shall submit a Road Management Plan to the FS and DEQ. This plan shall detail the specific location of all roads that need to be opened, constructed, or reconstructed. The OWNER must receive written approval of the plan from the FS and DEQ prior to gaining access on any

closed road or beginning any surface disturbing activity. This plan, once approved, shall be incorporated into Appendix D.

1.1.4. If special use areas are not known at the time of submission of the plan and profile, the following information shall be submitted no later than 5 days prior to the start of construction. The location of special use areas shall be plotted on one of the following and submitted to the KNF and STATE INSPECTORS: ortho-photomosaics of a scale 1:24,000 or larger, or available USGS 7.5' plan and profile maps of a scale 1:24,000 or larger, and an electronic equivalent agreed to by the DEQ and FS.

1.1.5. Changes or updates to the information submitted in 1.1.2 through 1.1.4 shall be submitted to the DEQ and FS for approval as they become available. In no case shall a change be submitted less than 5 days prior to its anticipated date of construction. Where changes affect designated SENSITIVE AREAS, these changes must be submitted to DEQ and FS 15 days before construction and approved by the STATE INSPECTOR on all lands and the KNF on FS lands prior to construction.

1.2. PRECONSTRUCTION CONFERENCE

1.2.1. At least one week before commencement of any construction activities, the OWNER shall schedule a preconstruction conference with DEQ and the FS. The KNF and STATE INSPECTORS shall be notified of the date and location for this meeting

1.2.2. The OWNER's representative, the CONTRACTOR's representative, the designated INSPECTORS, and representatives of affected state and federal agencies who have land management or permit and easement responsibilities shall be invited to attend the preconstruction conference.

1.3. PUBLIC CONTACT

1.3.1. Written notification by the OWNER's field representative or the CONTRACTOR shall be given to local public officials in each affected community prior to the beginning of construction to provide information on the temporary increase in population, when the increase is expected, and where the workers will be stationed. If local officials require further information, the OWNER shall hold meetings to discuss potential temporary changes. Officials contacted shall include the county commissioners, city administrators, and law enforcement officials. It is also suggested that local fire departments, emergency service providers, and a representative of the Chamber of Commerce be contacted.

1.3.2. The OWNER shall negotiate with the LANDOWNER in determining the best location for access easements and the need for gates.

1.3.3. The OWNER shall contact local government officials, MDT, or the managing agency, as appropriate, regarding implementation of required traffic safety measures.

1.4. PRECONSTRUCTION SURVEYS

1.4.1. The OWNER shall complete prior to construction an archaeological survey of all NFSL proposed for surface disturbance associated with transmission line construction. A similar survey on private land shall be coordinated with the LANDOWNER and be completed, if allowed by the LANDOWNER, before any land-disturbing activities occur. In addition, the OWNER shall develop a plan approved by the DEQ and FS that includes steps to be taken when sites are discovered during construction activities and describes the measures to be taken to identify, evaluate, and avoid or mitigate damage to cultural resources affected by the project. The plan (Appendix E) shall include: (1) actions taken to identify cultural resources during initial intensive survey work; (2) an evaluation of the significance of the identified sites and likely impacts caused by the project; (3) recommended treatments or measures to avoid or mitigate damage to known cultural sites; (4) steps to be taken in the event other sites are identified after approval of the plan; and (5) provisions for monitoring construction to protect cultural resources. Except for monitoring, all steps of the plan must be carried out prior to the start of construction in an area. The requirements for this plan should not be construed to exempt or alter compliance by the OWNER or managing agency with 36 CFR 800. However, compliance with 36 CFR 800 can be used to satisfy the requirements included in this section.

1.4.2. The OWNER shall complete a survey for threatened, endangered, or Forest sensitive plant species on NFSL for any areas where such surveys have not been completed and that will be disturbed by transmission line construction. Similarly, the OWNER, in coordination with the LANDOWNER, and if allowed by the LANDOWNER, shall conduct surveys in habitat suitable for threatened, endangered, and state-listed plant species potentially occurring on non-NFSL lands. The surveys shall be submitted to the DEQ and FS for approval. If adverse effects could not be avoided, OWNER shall develop appropriate mitigation plans for agency approval. The mitigation shall be implemented before any ground-disturbing activities.

1.4.3. The OWNER shall complete a jurisdictional wetland delineation of all areas proposed for ground disturbance associated with the transmission line, including all stream crossings by roads. The surveys would be submitted to the DEQ and FS for approval. If adverse effects could not be avoided, OWNER shall develop appropriate mitigation plans for agency approval. The mitigation shall be implemented before any ground-disturbing activities.

2.0 CONSTRUCTION

2.1. GENERAL

2.1.1. The preservation of the natural landscape contours and environmental features shall be an important consideration in the location of all construction facilities, including roads and special use areas. Construction of these facilities shall be planned and conducted so as to minimize destruction, scarring, or defacing of the natural vegetation and landscape. Any necessary earthmoving shall be planned and designed to be as compatible as possible with natural landforms.

2.1.2. Temporary special use areas shall be the minimum size necessary to perform the work. Such areas shall be located where most environmentally compatible, considering slope, fragile soils or vegetation, and risk of erosion. After construction, these areas shall be reclaimed as specified in Section 3.0 of these specifications unless a specific exemption is authorized in writing by the STATE INSPECTOR. On NFSL, these areas shall be reclaimed as specified in Section 3.0 of these specifications unless a specific exemption is authorized in writing by the KNF and STATE INSPECTORS.

2.1.3. All work areas shall be maintained in a neat, clean, and sanitary condition at all times. Trash or construction debris (in addition to solid wastes described in section 2.14) shall be regularly removed during the construction and reclamation periods.

2.1.4. In areas where mixing of soil horizons will lead to a significant reduction in soil productivity, increased difficulty in establishing permanent vegetation, or an increase in weeds, mixing of soil horizons shall be avoided insofar as possible. This may be done by removing and stockpiling topsoil, where practical, so that it may be spread over subsoil during site reclamation.

2.1.5. Vegetation such as trees, plants, shrubs, and grass on or adjacent to the right-of-way that does not interfere with the performance of construction work or operation of the line itself shall be preserved. The Vegetation Removal and Disposition Plan (Appendix F) shall identify the specific areas where vegetation will be removed or retained to minimize impacts from the construction and operation of the transmission line. This plan must be approved by the inspectors in their areas of jurisdiction prior to construction.

2.1.6. The OWNER shall take all necessary actions to avoid adverse impacts to SENSITIVE AREAS listed in Appendix A and implement the measures listed in Appendix A in these areas. The STATE INSPECTOR shall be notified 5 days in advance of initial clearing or construction activity in these areas. In addition the KNF INSPECTOR shall be notified 5 days in advance of initial clearing or construction activity on NFSL in these areas. The OWNER shall mark or flag the clearing backlines and limits of disturbance in certain SENSITIVE AREAS as designated in Appendix A. All construction activities must be conducted within this marked area.

2.1.7. The OWNER shall either acquire appropriate land rights or provide compensation for damage for the land area disturbed by construction. The width of the area disturbed by construction shall not exceed a reasonable distance from the centerline as necessary to perform the work. For this project, construction activities except access road construction and use of special use areas shall be contained within the area specified in Appendix G.

2.1.8. Flow in a stream course may not be permanently diverted. If temporary diversion is necessary for culvert installation, flow shall be restored immediately after culvert installation, as determined by the STATE INSPECTOR on all lands, and KNF INSPECTOR on NFSL.

2.2. CONSTRUCTION MONITORING

2.2.1. The STATE INSPECTOR is responsible for implementing the compliance monitoring required by ARM 17.20.1902. The STATE and KNF INSPECTORS are responsible for

implementing the compliance monitoring on NFSL. The plan specifies the type of monitoring data and activities required and terms and schedules of monitoring data collection, and assigns responsibilities for data collection, inspection reporting, and other monitoring activities. It is attached as Appendix H.

2.2.2. The INSPECTORS, the OWNER, and the OWNER'S agents shall attempt to rely upon a cooperative working relationship to reconcile potential problems relating to construction in SENSITIVE AREAS and compliance with these specifications. When construction activities cause excessive environmental impacts due to seasonal field conditions or damage to sensitive features, the designated INSPECTORS shall talk with the OWNER about possible mitigating measures or minor construction rescheduling to avoid these impacts and may impose additional mitigating measures. The INSPECTORS shall be prepared to provide the OWNER with written documentation of the reasons for the additional mitigating measures within 24 hours of their imposition. All parties shall attempt to adequately identify and address these areas and planned mitigation, to the extent practicable, during final design to minimize conflicts and delays during construction activities.

2.2.3. The INSPECTORS may require mitigating measures or procedures at some sites beyond those listed in Appendix A in order to minimize environmental damage due to unique circumstances that arise during construction, such as unanticipated discovery of a cultural site. The KNF INSPECTOR may require additional mitigating measures on NFSL. The INSPECTORS shall follow procedures described in the monitoring plan when such situations arise.

2.2.4. In the event that the STATE INSPECTOR shows reasonable cause that compliance with these specifications is not being achieved, and the OWNER has not taken reasonable efforts to remediate the situation, DEQ shall take corrective action as described in 75-20-408, MCA. In the event that the KNF INSPECTOR shows reasonable cause that compliance with these specifications is not being achieved, FS shall implement measures described in 36 CFR 228.7(b).

2.3. TIMING OF CONSTRUCTION

2.3.1. Construction and motorized travel may be restricted or prohibited at certain times of the year in certain areas. Exemptions to these timing restrictions may be granted by DEQ and FS in writing if the OWNER can clearly demonstrate that no significant environmental impacts will occur as a result. These areas are listed in Appendix I.

2.3.2. In order to prevent rutting and excessive damage to vegetation, construction will not take place during periods of high soil moisture when construction vehicles will cause severe rutting deeper than 4 inches requiring extensive reclamation.

2.4. PUBLIC SAFETY

2.4.1. All construction activities shall be done in compliance with existing health and safety laws.

2.4.2. Requirements for aeronautical hazard marking shall be determined by the OWNER in consultation with the Montana Aeronautical Division, the FAA, and the DEQ, and FS. These requirements are listed in Appendix J. Where required, aeronautical hazard markings shall be installed at the time the wires are strung, according to the specifications listed in Appendix J.

2.4.3. Noise levels shall not exceed established DEQ standards as a result of operation of the facility and associated facilities. For electric transmission facilities, the average annual noise levels, as expressed by an A-weighted day-night scale (Ldn) shall not exceed 50 decibels at the edge of the right-of-way in residential and subdivided areas unless the affected LANDOWNER waives this condition.

2.4.4. The facility shall be designed, constructed, and operated to adhere to the National Electrical Safety Code regarding transmission lines.

2.4.5. The electric field at the edge of the right-of-way shall not exceed 1 kilovolt per meter measured 1 meter above the ground in residential or subdivided areas unless the affected LANDOWNER waives this condition, and that the electric field at road crossings under the facility shall not exceed 7 kilovolts per meter measured 1 meter above the ground.

2.5. PROTECTION OF PROPERTY

2.5.1. Construction operations shall not take place over or upon the right-of-way of any railroad, public road, public trail, or other public property until negotiations and/or necessary approvals have been completed with the LANDOWNER or FS, and on lands subject to a conservation easement, FWP. Designated roads and trails as listed in Appendix A and Appendix D shall be protected and kept open for public use. Where it is necessary to cross a trail with access roads, the trail corridor shall be restored. Adequate signing and/or blazes shall be established so the user can find the route. All roads and trails designated by any government agency as needed for fire protection or other purposes shall be kept free of logs, brush, and debris resulting from operations under this agreement. Any such road or trail damaged by project construction or maintenance shall be promptly restored to its original condition.

2.5.2. Reasonable precautions shall be taken to protect, in place, all public land monuments and private property corners or boundary markers. If any such land markers or monuments are destroyed, the marker shall be reestablished and referenced in accordance with the procedures outlined in the "Manual of Instruction for the Survey of the Public Land of the United States" or, in the case of private property, the specifications of the county engineer. Reestablishment of survey markers shall be at the expense of the OWNER.

2.5.3. Construction shall be conducted so as to prevent any damage to existing real property including transmission lines, distribution lines, telephone lines, railroads, ditches, and public roads crossed. If such property is damaged during construction, operation, or decommissioning, the OWNER shall repair such damage immediately to a reasonably satisfactory condition in consultation with the property owner. The LANDOWNER shall be compensated for any losses to personal property due to construction, operation, or decommissioning activities.

2.5.4. In areas with livestock, the OWNER shall make a reasonable effort to comply with the reasonable requests of LANDOWNERS regarding measures to control livestock. Unless requested by a LANDOWNER, care shall be taken to ensure that all gates are closed after entry or exit. Gates shall be inspected and repaired when necessary during construction and missing padlocks shall be replaced. The OWNER shall ensure that gates are not left open at night or during periods of no construction activity unless other requests are made by the LANDOWNER. Any fencing or gates cut, removed, damaged, or destroyed by the OWNER shall immediately be replaced with new materials. Fences installed shall be of the same height and general type as the fence replaced or nearby fence on the same property, and shall be stretched tight with a fence stretcher before stapling or securing to the fence post. Temporary gates shall be of sufficiently high quality to withstand repeated opening and closing during construction, to the satisfaction of the LANDOWNER.

2.5.5. The OWNER must notify the STATE INSPECTOR, KNF INSPECTOR and, if possible, the affected LANDOWNER within 2 days of damage to land, crops, property, or irrigation facilities, contamination or degradation of water, or livestock injury caused by the CONTRACTOR and/or the OWNER's activities, and the OWNER shall reasonably restore any damaged resource and/or replace where applicable damaged property. The OWNER shall provide reasonable compensation for damages to the affected landowner.

2.5.6. Pole holes and anchor holes must be covered or fenced in any fields, pastures, or ranges being used for livestock grazing or where a LANDOWNER's requests can be reasonably accommodated.

2.5.7. When requested by the LANDOWNER, all fences crossed by permanent access roads shall be provided with a gate. All fences to be crossed by access roads shall be braced before the fence is cut. Fences not to be gated should be restrung temporarily during construction and restrung permanently within 30 days following construction, subject to the reasonable desires of the LANDOWNER.

2.5.8. Where new access roads cross fence lines, the OWNER shall make reasonable effort to accommodate the LANDOWNER's wishes on gate location and width.

2.5.9. Any breaching of natural barriers to livestock movement by construction activities shall require fencing sufficient to control livestock.

2.6. TRAFFIC CONTROL

2.6.1. At least 30 days before any construction within or over any state or federal highway right-of-way or paved secondary highway for which MDT has maintenance, the OWNER shall notify the appropriate MDT field office to review the proposed occupancy and to obtain appropriate permits and authorizations. The OWNER must supply DEQ and FS with documentation that this consultation has occurred. This documentation shall include any measures recommended by MDT that apply to state highways and to what extent the OWNER has agreed to comply with these measures. In the event that recommendations or regulations will not be followed, DEQ shall resolve any disputes regarding state highways.

2.6.2. In areas where the construction creates a hazard, traffic shall be controlled according to the applicable MDT regulations. Safety signs advising motorists of construction equipment shall be placed on major state highways, as recommended by MDT. The installation of proper road signing shall be the responsibility of the OWNER.

2.6.3. The managing agency shall be notified, as soon practicable, when it is necessary to close public roads to public travel for short periods to provide safety during construction.

2.6.4. Construction vehicles and equipment shall be operated at speeds safe for existing road and traffic conditions.

2.6.5. Traffic delays shall be restricted on primary access routes, as determined by MDT on state or federal highways or FS on its roads.

2.6.6. Access for fire and emergency vehicles shall be provided for at all times.

2.6.7. Public travel through and use of active construction areas shall be limited at the discretion of the managing agency.

2.7. ACCESS ROADS AND VEHICLE MOVEMENT

2.7.1. Construction of new roads shall be the minimum reasonably required to construct and maintain the facility in accordance with the Road Management Plan in Appendix D. National Forest System, State, county, and other existing roads shall be used for construction access wherever possible. The location of access roads and structures shall be established in consultation with affected LANDOWNERS and LANDOWNER concerns shall be accommodated where reasonably possible and not in contradiction to these specifications or other appropriate FS and DEQ conditions.

2.7.2. All new roads, both temporary and permanent, shall be constructed with the minimum possible clearing and soil disturbance to minimize erosion, as specified in Section 2.11 of these specifications.

2.7.3. Where practical, all roads shall be initially designed to accommodate one-way travel of the largest piece of equipment that will be required to use them; road width shall be no wider than necessary.

2.7.4. Roads shall be located as approved in the Road Management Plan (Appendix D). Travel outside the right-of-way to enable traffic to avoid cables and conductors during conductor stringing shall be kept to the minimum possible. Road crossings of the right-of-way shall be near support structures to the extent feasible.

2.7.5. Helicopter construction techniques shall be used as specified on Figure F-6 of the draft EIS. Helicopter stringing shall also be used on the line. Where overland travel routes are used, they shall not be graded or bladed unless necessary and shall be flagged or otherwise marked to

show their location and to prevent travel off the overland travel route. Where temporary roads are required, they shall be constructed on the most level land available.

2.7.6. In order to minimize soil disturbance and erosion potential, cutting and filling for access road construction shall be kept to a minimum to the extent practicable, in areas of up to 5 percent side slope. In areas of over 5 percent side slope, roads shall be constructed to prevent channeling of runoff.

2.7.7. The OWNER shall complete the measures necessary so the KNF could place all new roads constructed for the transmission line on NFSL into intermittent stored service. Such requirements are described in Appendix D. The OWNER shall restrict access to closed roads during construction. Closure devices shall be reinstalled following construction on existing closed roads. On private lands, the OWNER shall cooperate with the LANDOWNER to develop a similar approach to meet the LANDOWNER's land use requirements while minimizing environmental impacts.

2.7.8. Any damage to existing private roads, including rutting, resulting from project construction, operation, or decommissioning shall be repaired and restored to a condition as good or better than original as soon as possible. Repair and restoration of roads shall be accomplished during and following construction as necessary to reduce erosion.

2.7.9. Any necessary snow removal shall be done in a manner to preserve and protect roads, signs, and culverts, to ensure safe and efficient transportation, and to prevent excessive erosion damage to roads, streams, and adjacent land. All snow removal shall be done in compliance with INFS standards.

2.7.10. At least 30 days prior to construction of a new access road approach intersecting a state or federal highway, or of any structure encroaching upon a highway right-of-way, the OWNER shall submit to MDT a plan and profile map showing the location of the proposed construction. At least five days prior to construction, the OWNER shall provide the designated INSPECTORS written documentation of this consultation and actions to be taken by the OWNER as provided in 2.6.1.

2.8. EQUIPMENT OPERATION

2.8.1. During construction, unauthorized cross-country travel and the development of roads other than those approved shall be prohibited. The OWNER shall be liable for any damage, destruction, or disruption of private property and land caused by his construction personnel and equipment as a result of unauthorized cross-country travel and/or road development.

2.8.2. To prevent excessive soil damage in areas where a graded roadway has not been constructed, the limits and locations of access for construction equipment and vehicles shall be clearly marked or specified at each new site before any equipment is moved to the site. CONTRACTOR personnel shall be well versed in recognizing these markers and shall understand the restriction on equipment movement that is involved.

2.8.3. Dust control measures on all roads used for construction shall be implemented in accordance with DEQ's air quality permit and the KNF's Plan of Operations. Where requested by residents living within 500 feet of the line, the OWNER shall control dust created by transmission line construction activities. Oil or similar petroleum-derivatives shall not be used to control dust.

2.8.4. Work crew foremen shall be qualified and experienced in the type of work being accomplished by the crew they are supervising. Earthmoving equipment shall be operated only by qualified, experienced personnel. Correction of environmental damage resulting from operation of equipment by inexperienced personnel shall be the responsibility of the OWNER. Repair of damage to a condition reasonably satisfactory to the LANDOWNER, FS, or if necessary, DEQ, will be required.

2.8.5. Sock lines or pulling lines shall be strung using a helicopter to minimize disturbance of soils and vegetation.

2.8.6. Following construction in areas designated by the local weed control board, DEQ, or FS on NFSL as a noxious weed areas, the CONTRACTOR shall thoroughly clean all vehicles and equipment to remove weed parts and seeds immediately prior to leaving the area. Such areas are shown in Appendix K.

2.9. RIGHT-OF-WAY CLEARING AND SITE PREPARATION

2.9.1. The STATE INSPECTOR shall be notified at least 10 days prior to any vegetation clearing; the STATE INSPECTOR and KNF shall be notified at least 10 days prior to any vegetation clearing on NFSL. The STATE INSPECTOR shall be responsible for notifying the DNRC Forestry Division. All vegetation clearing shall be conducted in accordance with the Vegetation Removal and Disposition Plan (Appendix F).

2.9.2. Right-of-way clearing shall be kept to the minimum necessary to meet the requirements of the National Electrical Safety Code. Clearing shall produce a "feathered edge" right-of-way configuration, where only specified hazard trees and those that interfere with construction or conductor clearance are removed. Trees to be saved within the clearing back lines and danger trees located outside the clearing back lines shall be marked. Clearing back lines in SENSITIVE AREAS shall be indicated on plan and profile maps. All snags and old growth trees that do not endanger the line or maintenance equipment shall be preserved. In designated SENSITIVE AREAS, the INSPECTORS may approve clearing measures and boundaries that vary from the design plan prior to clearing.

2.9.3. During clearing of survey lines or the right-of-way, small trees and shrubs shall be preserved to the greatest extent possible in accordance with the Vegetation Removal and Disposition Plan and in compliance with the National Electrical Safety Code. Shrub removal shall be limited to crushing where necessary. Plants may be cut off at ground level, leaving roots undisturbed so that they may re-sprout.

2.9.4. In no case shall the cleared width be greater than that described in the Vegetation Removal and Disposition Plan and the National Electrical Safety Code, unless approved by the INSPECTORS on NFSL and the State INSPECTOR and LANDOWNER on private land.

2.9.5. Soil disturbance and earth moving shall be kept to a minimum.

2.9.6. The OWNER shall be held liable for any unauthorized cutting, injury or destruction to timber whether such timber is on or off the right-of-way.

2.9.7. Unless otherwise requested by the LANDOWNER or FS, felling shall be directional in order to minimize damage to remaining trees. Maximum stump height shall be no more than 12 inches on the uphill side or 1/3 the tree diameter, whichever is greater. Trees shall not be pushed or pulled over. Stumps shall not be removed unless they conflict with a structure, anchor, or roadway.

2.9.8. Crane landings shall be constructed on level ground unless extreme conditions (such as soft or marshy ground) make other construction necessary. In areas where more than one crane landing per structure site is built, the STATE INSPECTOR shall be notified at least 5 days prior to the beginning of construction at those sites.

2.9.9. No motorized travel on, scarification of, or displacement of talus slopes shall be allowed except where approved by the STATE INSPECTOR on all lands, the KNF INSPECTOR on NFSL, and LANDOWNER.

2.9.10. To avoid unnecessary ground disturbance, counterpoise should be placed or buried in disturbed areas whenever possible.

2.9.11. Slash resulting from project clearing that may be washed out by high water the following spring shall be removed and piled outside the floodplain before runoff. Any instream slash resulting from project clearing to be removed shall be removed within 24 hours. OWNER shall leave large woody material for small mammals and other wildlife species within the cleared area on NFSL.

2.9.12. Use of heavy equipment to clear and remove vegetation in riparian areas shall be minimized.

2.10. GROUNDING

2.10.1 Grounding of fences, buildings, and other structures on and adjacent to the right-of-way shall be done according to the specifications of the National Electrical Safety Code.

2.11. EROSION AND SEDIMENT CONTROL

2.11.1. Clearing and grubbing for roads and rights-of-way and excavations for stream crossings shall be carefully controlled to minimize silt or other water pollution downstream from the rights-of-way. At a minimum, erosion control measures described in the OWNER's Storm Water

Pollution Prevention Plan and INFS standards shall be implemented as appropriate following the review of the plan and profile map(s) required under Section 0.9 and 1.1.2.

2.11.2. Roads shall cross drainage bottoms at sharp or nearly right angles and level with the stream bed whenever possible. Temporary bridges, fords, culverts, or other structures to avoid stream bank damage shall be installed.

2.11.3. Under no circumstances shall stream bed materials be removed for use as backfill, embankments, road surfacing, or for other construction purposes.

2.11.4. No excavations shall be allowed on any river or perennial stream channels or floodways at locations likely to cause detrimental erosion or offer a new channel to the river or stream at times of flooding.

2.11.5. Installation of culverts, bridges, or other structures at stream crossings shall be done as specified by the INSPECTORS following on-site inspections with DEQ, FS, FWP, and local conservation districts. Installation of culverts or other structures in a water of the United States shall be in accordance with the U.S. Army Corps of Engineers 404 and DEQ 318 permit conditions. All culverts shall be sized according to Revised Hydraulic Guide Kootenai National Forest (1990) and amendments. Where new culverts are installed, they shall be installed with the culvert inlet and outlet at natural stream grade or ground level. Water velocities or positioning of culverts shall not impair fish passage. Stream crossing structures need to be able to pass the 100 year flow event.

2.11.6. Following submittal of a plan and profile maps, but prior to construction of access roads, bridges, fill slopes, culverts, impoundments, or channel changes within the high-water mark of any perennial stream, lake, or pond, the OWNER shall discuss proposed activities with the STATE INSPECTOR, FWP, local conservation district, and KNF personnel. This site review shall determine the specific mitigation measures to minimize impacts appropriate to the conditions present. These measures shall be added to Appendix A by the STATE INSPECTOR and as appropriate by the KNF INSPECTOR.

2.11.7. No blasting shall be allowed in streams. Blasting may be allowed near streams if precautions are taken to protect the stream from debris and from entry of nitrates or other contaminants into the stream. No blasting debris shall be placed into a water of the United States without a U.S. Army Corps of Engineers 404 and DEQ 318 permit.

2.11.8. The OWNER shall maintain roads on private lands while using them. All ruts made by machinery shall be filled or graded to prevent channeling. In addition, the OWNER must take measures to prevent the occurrence of erosion caused by wind or water during and after use of these roads. Some erosion-preventive measures include but are not limited to, installing or using cross-logs, drain ditches, water bars, and wind erosion inhibitors such as water, straw, gravel, or combinations of these. Erosion control shall be accomplished as described in the OWNER's General Stormwater Permit (or MPDES Permit) and the Storm Water Pollution Prevention Plan.

2.11.9. The OWNER shall prevent material from being deposited in any watercourse or stream channel. Where necessary, measures such as hauling of fill material, construction of temporary barriers, or other approved methods shall be used to keep excavated materials and other extraneous materials out of watercourses. Any such materials entering watercourses shall be removed immediately.

2.11.10. The OWNER shall be responsible for the stability of all embankments created during construction. Embankments and backfills shall contain no stream sediments, frozen material, large roots, sod, or other materials that may reduce their stability.

2.11.11. No fill material other than that necessary for road construction shall be piled within the high water zone of streams where floods can transport it directly into the stream. Excess floatable debris shall be removed from areas immediately above crossings to prevent obstruction of culverts or bridges during periods of high water.

2.11.12. No skidding of logs or driving of vehicles across a perennial watercourse shall be allowed, except via authorized construction roads.

2.11.13. Skidding with tractors shall not be permitted within 100 feet of streams containing flowing water except in places designated in advance, and in no event shall skid roads be located on these stream courses. Skid trails shall be located high enough out of draws, swales, and valley bottoms to permit diversion of runoff water to natural undisturbed forest ground cover.

2.11.14. Construction methods shall prevent accidental spillage of solid matter, contaminants, debris, petroleum products, and other objectionable pollutants and wastes into watercourses, lakes, and underground water sources. Secondary containment catchment basins capable of containing the maximum accidental spill shall be installed at areas where fuel, chemicals or oil are stored. Any accidental spills of such materials shall be cleaned up immediately.

2.11.15. To reduce the amount of sediment entering streams, vegetation clearing in Riparian Habitat Conservation Areas on NFSL and other riparian areas on private lands shall be conducted in accordance with the Vegetation Removal and Disposition Plan and the Storm Water Pollution Prevention Plan, to be submitted for approval by the DEQ and the FS.

2.11.16. Damage resulting from erosion or other causes from construction activities and disturbance areas shall be repaired after completion of grading and before revegetation is begun.

2.11.17. Stormwater discharge of water shall be dispersed in a manner to avoid erosion or sedimentation of streams as required in DEQ permits.

2.11.18. Riprap or other erosion control activities shall be planned based on possible downstream consequences of activity, and installed during the low flow season if possible. Timing restrictions are presented in Appendix I.

2.11.19. Water used in embankment material processing, aggregate processing, concrete curing, foundation and concrete lift cleanup, and other wastewater processes shall not be discharged into surface waters without a valid discharge permit from DEQ.

2.12. ARCHAEOLOGICAL, HISTORICAL, AND PALEONTOLOGIC RESOURCES

2.12.1. All construction activities shall be conducted so as to prevent damage to significant archaeological, historical, or paleontological resources, in accordance with the requirements of 1.4.1 and Appendix E.

2.12.2. Any relics, artifacts, fossils or other items of historical, paleontological, or archaeological value shall be preserved in a manner agreeable to both the LANDOWNER and the SHPO. If any such items are discovered during construction, SHPO shall be notified immediately. If any such items are discovered on NFSL during construction, the FS Archaeologist shall also be notified immediately. Work which could disturb the materials or surrounding area must cease until the site can be properly evaluated by a qualified archaeologist (either employed by the OWNER and approved by the appropriate agency, managing agency, or representing SHPO) and recommendations made by that person based on the Historic Preservation Plan outlined in Appendix E. For sites eligible for listing in the National Registry of Historic Places, recommendations of SHPO must be followed by the OWNER.

2.12.3. The OWNER shall conform to treatments recommended for cultural resources by SHPO and the FS if on NFSL and on private land with concurrence by the LANDOWNER.

2.13. PREVENTION AND CONTROL OF FIRES

2.13.1. Burning, fire prevention, and fire control shall meet the requirements of the managing agency and/or the fire control agencies having jurisdiction. The STATE and KNF INSPECTORS shall be invited to attend all meetings with these agencies to discuss or prepare these plans. A copy of agreed upon plans shall be included in Appendix L

2.13.2. The OWNER shall direct the CONTRACTOR to comply with regulations of any county, town, state or governing municipality having jurisdiction regarding fire laws and regulations.

2.13.3. Blasting caps and powder shall be stored only in approved areas and containers and always separate from each other.

2.13.4. The OWNER shall direct the CONTRACTOR to properly store and handle combustible material that could create objectionable smoke, odors, or fumes. The OWNER shall direct the CONTRACTOR not to burn refuse such as trash, rags, tires, plastics, or other debris, except as permitted by the county, town, state, or governing municipality having jurisdiction.

2.14. WASTE DISPOSAL

2.14.1. The OWNER shall direct the CONTRACTOR to use licensed solid waste disposal sites. Inert materials (Group III wastes) may be disposed of at licensed Class III landfill sites; mixed refuse (Group II wastes) must be disposed of at licensed Class II landfill sites.

2.14.2. Emptied pesticide containers or other chemical containers must be triple rinsed to render them acceptable for disposal in Class II landfills or for scrap recycling pursuant to ARM 17.54.201 for treatment or disposal. Pesticide residue and pesticide containers shall be disposed of in accordance with ARM 17.30.637.

2.14.3. All waste materials constituting a hazardous waste defined in ARM 16.44.303, and wastes containing any concentration of polychlorinated biphenyls must be transported to an approved designated hazardous waste management facility (as defined in ARM 17.53.201) for treatment or disposal.

2.14.4. All used oil shall be hauled away and recycled or disposed of in a licensed Class II landfill authorized to accept liquid wastes or in accordance with 2.14.2 and 2.14.3 above. There shall be no intentional release of oil or other toxic substances into streams or soil. In the event of an accidental spill into a waterway, the INSPECTORS shall be contacted immediately. Any spill of refined petroleum products greater than 25 gallons must be reported to the State at the Department of Military Affairs, Disaster and Emergency Services Division at 406-841-3911. All spills shall be cleaned up in accordance with the OWNER's Emergency Spill Response Plan.

2.14.5. Sewage shall not be discharged into streams or streambeds. The OWNER shall direct the CONTRACTOR to provide refuse containers and sanitary chemical toilets, convenient to all principal points of operation. These facilities shall comply with applicable federal, state, and local health laws and regulations. A septic tank pump licensed by the State shall service these facilities.

2.14.6. Slash from vegetation clearing along the transmission line shall be managed in accordance with the Vegetation Removal and Disposition Plan, Montana law regarding reduction of slash (76-13-407, MCA) and, on NFSL, KNF objectives regarding fuels reduction.

2.14.7 On NFSL, merchantable timber shall be transported to designated landings or staging areas, and branches and tops shall be removed and piled. The FS shall be responsible for disposing of the piles on NFSL and the OWNER shall be responsible for disposal of the piles on other lands. All merchantable timber shall be removed from the transmission line clearing area on NFSL unless authorized in writing by an authorized FS representative. Non-merchantable trees and coniferous forest debris shall be removed using a brush blade or excavator to minimize soil accumulation. Excess slash shall be removed or burned in all timber harvest areas and within ½ mile of any residence. The FS shall be responsible for disposing of the piles on FS land and the OWNER shall be responsible for disposal of the piles on other lands. Non-merchantable material left within the transmission line clearing area shall be lopped and scattered unless otherwise requested by the KNF.

2.14.8. On private land, management of merchantable and non-merchantable trees as well as slash shall be negotiated between LANDOWNER and OWNER.

2.14.9. Refuse burning shall require the prior approval of the LANDOWNER and a Montana Open Burning Permit must be obtained from the DEQ. Any burning of wastes shall comply with section 2.13 of these specifications.

3.2.10. Burning of vegetation shall be in accordance with the Vegetation Removal and Disposition Plan. Piling and windrowing of material for burning shall use methods that shall prevent significant amounts of soil from being included in the material to be burned and minimize destruction of ground cover. Piles shall be located so as to minimize danger to timber and damage to ground cover when burned.

2.15. SPECIAL MEASURES

2.15.1 Structures and conductors with a low reflectivity constant shall be used to reduce potential for visual contrast.

2.15.2 Crossings of rivers should be at approximately right angles. Strategic placement of structures should be done both as a means to screen views of the transmission line and right-of-way and to minimize the need for vegetative clearing.

2.15.3 To prevent avian collisions with the transmission lines, the visibility of conductors or shield wires shall be increased where necessary. This may include installation of marker balls, bird diverters, or other line visibility devices placed in varying configurations, depending on line design and location. Areas of high risk for bird collisions where such devices may be needed, such as major drainage crossings, and recommendations for type of marking device, shall be identified through a study conducted by a qualified biologist and funded by the OWNER.

2.15.4 Based on the analysis contained in the EIS and findings made by the DEQ or the BOARD, general mitigations also may apply to construction and operation of the project. These measures are found in Appendix A.

3.0 POST-CONSTRUCTION CLEANUP AND RECLAMATION

3.1. CLEANUP

3.1.1. All litter resulting from construction is to be removed, to the satisfaction of the LANDOWNER on private lands and the FS on NFSL, from the right-of-way and along access roads leading to the right-of-way. Such litter shall be legally disposed of as soon as possible, but in no case later than 60 days following completion of wire clipping. If requested by the LANDOWNER and the FS on NFSL, the OWNER shall provide for removal of any additional construction-related debris discovered after this initial cleanup.

3.1.2. Insofar as practical, all signs of temporary construction facilities such as haul roads, work areas, buildings, foundations or temporary structures, soil stockpiles, excess or waste materials,

or any other vestiges of construction shall be removed and the areas restored to as natural a condition as is practical, in consultation with the LANDOWNER and the FS on NFSL.

3.2 RECLAMATION

3.2.1 Revegetation of the right-of-way, access roads, all special use area, or any other disturbance shall be consistent with the reclamation and revegetation standards and provisions contained in ARM 17.20.1902 and the approved Plan of Operations on NFSL. This plan and any conditions to the certificate approved by DEQ shall be attached as Appendix M.

3.2.2 Scarring or damage to any landscape feature listed in Appendix A shall be reclaimed as nearly as practical to its original condition. Bare areas created by construction activities shall be reseeded in compliance with Appendix M to prevent soil erosion.

3.2.3 After construction is complete, NFSL roads shall be reclaimed as described in Appendix D. Roads on private lands shall be managed in accordance with the agreement between LANDOWNER and OWNER.

3.2.4. Fill slopes associated with access roads adjacent to stream crossing shall be regraded at slopes less than the normal angle of repose for the soil type involved.

3.2.5. All drainage channels, where construction activities occurred, shall be restored to a gradient and width that shall prevent accelerated gully erosion (see Section 2.11.11).

3.2.6. Drive-through dips, open-top box culverts, waterbars, or cross drains shall be added to roads at the proper spacing and angle as necessary to prevent erosion. The suggested spacing of drive thru dips and relief culverts is discussed in the KNF Revised Hydraulic Guide (1990) and shall be used to establish the locations of these items.

3.2.7. Interrupted drainage systems shall be restored.

3.2.8. Sidecasting of waste materials may be allowed on slopes over 40 percent after approval by the LANDOWNER and FS, however, this will not be allowed within the buffer strip established for stream courses, in areas of high or extreme soil instability, or in other SENSITIVE AREAS identified in Appendix A. Surplus materials shall be hauled to sites approved by LANDOWNER and FS in such areas.

3.2.9. Seeding prescriptions to be used in revegetation, requirements for hydroseeding, fertilizing, and mulching, as jointly determined by representatives of the OWNER, DEQ, FS, and other involved state and federal agencies, are specified in Appendix M.

3.2.10. During the initial reclamation of construction disturbance in areas where topsoil has been stockpiled, the surface shall be graded to a stable configuration and the topsoil shall be replaced on the disturbed area. The STATE INSPECTOR may waive the requirement for topsoil replacement on private lands on a site-specific basis where additional disturbance at a site

increases erosion, sedimentation, or reclamation problems. Similarly, the KNF INSPECTOR may waive such requirements on NFSL.

3.2.11. Excavated material not suitable or required for backfill shall be evenly filled back onto the cleared area prior to spreading any stockpiled soil. Large rocks and boulders uncovered during excavation and not buried in the backfill shall be disposed of as approved by the STATE and KNF INSPECTORS and/or LANDOWNER.

3.2.12. Application rates and timing of seeds and fertilizer, and purity and germination rates of seed mixtures, shall be as determined in consultation with DEQ and FS. Reseeding shall be done at the first appropriate opportunity after construction ends.

3.2.13. Where appropriate, hydro seeding, drilling, or other appropriate methods shall be used to aid revegetation. Mulching with straw, wood chips, or other means shall be used where necessary. Areas requiring such treatment are listed in Appendix M.

3.3. MONITORING CONSTRUCTION AND RECLAMATION ACTIVITIES

3.3.1. Upon notice by the OWNER, the INSPECTORS shall schedule initial post-construction field inspections following clean up and road closure. Follow-up visits shall be scheduled as required to monitor the effectiveness of erosion controls, reseeding measures, and the Reclamation and Revegetation Plan (Appendix M). The STATE INSPECTOR shall contact the LANDOWNER for post-construction access and to determine LANDOWNER satisfaction with the OWNER'S reclamation measures.

3.3.2. The STATE INSPECTOR shall document observations on all lands for inclusion in monitoring reports regarding bond release required by DEQ. Such observations shall be coordinated with the KNF INSPECTOR on NFSL and the OWNER.

3.3.3. Release of the Transmission Line Construction and Reclamation Bond shall be based on completing the activities specified in the Reclamation and Revegetation Plan (Appendix M). Failure of the OWNER to complete the activities on disturbed areas in accordance with Appendix M and successfully revegetate disturbed areas shall be cause for forfeiture for the BOND or penalties described in Section 0.3. Failure of the OWNER to adequately reclaim all disturbed areas in accordance with section 3.2 and Appendix M of these specifications shall be cause for forfeiture of the BOND or penalties described in Section 0.9. Reclamation shall be in accordance with the standards established in ARM 17.20.1902 and in forested areas the right of way and unneeded roads shall be stocked naturally or planted with trees so that upon maturity, the canopy cover approximates that of adjacent undisturbed areas. Noxious weeds shall be controlled on disturbed areas.

4.0. OPERATION AND MAINTENANCE

4.1. RIGHT-OF-WAY MANAGEMENT

4.1.1. Maintenance of the right-of-way shall be as specified in the Weed Control Plan (Appendix K) and other monitoring and mitigation plans described in the KNF's Plan of Operations. This plan shall provide for the protection of SENSITIVE AREAS identified prior to and during construction. OWNER and CONTRACTOR activities off the right-of–way such as along access roads shall be consistent with best management practices and environmental protection measures contained in these specifications.

4.1.2. Vegetation that has been saved through the construction process and which does not pose a hazard or potential hazard to the transmission line, particularly that of value to fish and wildlife as specified in Appendix A, shall be allowed to grow on the right-of-way. Vegetation management shall be in accordance with the Vegetation Removal and Disposition Plan (Appendix F).

4.1.3. Vegetative cover along the transmission line and roads shall be maintained in cooperation with the LANDOWNER on private lands and the FS on NFSL.

4.1.4. Grass cover, water bars, cross drains, the proper slope, and other agreed to measures shall be maintained on permanent access roads on private lands and service roads in order to prevent soil erosion.

4.2. MAINTENANCE INSPECTIONS

4.2.1. The OWNER shall have responsibility to correct soil erosion or revegetation problems on the right-of-way or access roads as they become known. Maintenance of roads on NFSL shall be in accordance with the Road Management Plan. Appropriate corrective action shall be taken where necessary. The OWNER, through agreement with the LANDOWNER or FS, may provide a mechanism to identify and correct such problems.

4.2.2. Operation and maintenance inspections using ground vehicles shall be timed so that routine maintenance shall be done when access roads are firm, dry, or frozen, wherever possible. New roads, and existing barriered or impassable roads used for transmission line construction on NFSL shall not be used for routine maintenance; use of such roads shall be for emergency maintenance only. Maintenance vegetative clearing shall be done according to criteria described in Appendix F.

4.3. CORRECTION OF LANDOWNER PROBLEMS

4.3.1. When the facility causes interference with radio, TV, or other stationary communication systems, the OWNER shall correct the interference with mechanical corrections to facility hardware, or antennas, or shall install remote antennas or repeater stations, or shall use other reasonable means to correct the problem.

4.3.2. The OWNER shall respond to complaints of interference by investigating complaints to determine the origin of the interference. If the interference is not caused by the facility, the OWNER shall so inform the person bringing the complaint. The OWNER shall provide the

STATE INSPECTOR with documentation of the evidence regarding the source of the interference if the person brings the complaint to the STATE INSPECTOR or DEQ.

4.4. HERBICIDES AND WEED CONTROL

4.4.1. To minimize spreading weeds during construction, a joint weed inspection of the transmission line corridor and/or construction areas may be completed prior to construction areas. The joint inspection is intended to identify areas with existing high weed concentration. This joint review may include the OWNER, affected weed control boards, FS and LANDOWNERS.

4.4.2. Weed control, including any application of herbicides in the right-of-way, shall be done by applicators licensed in Montana and in accordance with recommendations of the Montana Department of Agriculture, FS on NFSL, and in accordance with the Weed Control Plan in Appendix K.

4.4.3. Herbicides shall not be used in certain areas identified by DEQ, FS, and FWP, as listed in Appendix K.

4.4.4. Proper herbicide application methods shall be used to keep drift and nontarget damage to a minimum.

4.4.5. The OWNER shall notify the STATE and KNF INSPECTORS (if involving NFSL) in writing 30 days prior to any broadcast or aerial spraying of herbicides. The notice shall provide details as to the time, place, and justification for such spraying. DEQ, FWP, the Montana Department of Agriculture, and FS, if involving NFSL, shall have the opportunity to inspect the portion of the right-of-way or access roads schedule for such treatment before, during, and after spraying.

4.5. CONTINUED MONITORING

4.5.1. The KNF and DEQ may continue to monitor operation and maintenance activities for the life of the transmission line in order to ensure compliance with the KNF's Plan of Operations and the Certificate of Compliance.

5.0. ABANDONMENT, DECOMMISSIONING AND RECLAMATION FOLLOWING DECOMMISSIONING

When the transmission line is no longer used or useful, structures, conductors, and ground wires shall be removed, roads recontoured and disturbed areas reclaimed using methods outlined in Appendix N.

APPENDICES

Appendix A: Sensitive Areas for the Montanore Project.

The following sensitive areas have been identified on Figure D-1 of the draft EIS where special measures will be taken to reduce impacts during construction and reclamation activities:

- Wetlands
- Riparian corridors
- Bull trout critical habitat
- Old growth habitat
- Core grizzly bear habitat
- Bald eagle primary use areas
- Areas with high risk of bird collisions
- Big game winter range
- Visually sensitive and high visibility areas
- Cultural resources (not shown on Figure D-1)
- Additional areas for monitoring may be identified following the preconstruction monitoring trip by the INSPECTORS or preconstruction surveys by the OWNER (see Appendix I)

Area where helicopters will be used to construct the line are identified in Figure F-6 of the draft EIS. Helicopter stringing of the line will be required to minimize construction disturbance during the stringing phase.

Once the preferred alignment has been selected by the FS and the DEQ during the EIS process, specific areas will be identified and mitigation incorporated into the final design to address sensitive areas of the transmission line.

Appendix B: Performance Bond Specifications

The Transmission Line Construction and Reclamation Bond and Joint Decommissioning Bond shall be used to ensure compliance with these specifications. The amount of the Construction and Reclamation Bond will be determined by the DEQ and FS within 45 days after the information required is Section 1.1 – 1.3 has been submitted. The Joint Decommissioning Bond will also be determined by the DEQ and FS with in 45 days the information required in Section 1.1 – 1.3 has been submitted. These bonds must be submitted prior to the start of construction. The amount of the bonds will be reviewed and updated every 5 years by DEQ and FS.

Appendix C: Name and Address of Inspectors and Owner's Liaison

STATE INSPECTOR
Environmental Science Specialist
Montana Department of Environmental Quality
P.O. Box 200901, 1520 East Sixth Avenue
Helena, Montana 59620-0901
(406) 444-____

OWNER'S LIAISON
Environmental Specialist
Montanore Minerals Corp.
34524 U.S. Highway 2 West
Libby Montana 59923
(406) 293_____

KNF INSPECTOR
Kootenai National Forest
1101 U.S. Highway 2 West
Libby Montana 59923
(406) 293-_____

Appendix D: Road Management Plan

OWNER shall develop for the lead agencies' review and approval, and implement a final Road Management Plan that describes for all new and reconstructed roads used for the transmission line the following:

- Criteria that govern road operation, maintenance, and management
- Requirements for pre-, during-, and post-storm inspections and maintenance
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives
- Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control
- Mitigation plans for road failures

OWNER shall be responsible for implementing one or more of the following measures on newly constructed roads and reconstructed roads on NFSL so they cause little resource risk if maintenance is not performed on them during the operation period and prior to their future need:

- Conducting noxious weed surveys and performing necessary weed treatments prior to storage activities
- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high-risk for blockage or failure; laying back stream banks at a width and angle to allow flows to pass without scouring or ponding so that revegetation has a strong chance of success
- Installing cross drains so the road surface and inside ditch would not route any intercepted flow to ditch-relief or stream-crossing culverts
- Removing and placing unstable material at a stable location where stored material would not present a future risk to watershed function

- Replacing salvaged soil and revegetating with grasses in treated areas and unstable roadway segments to stabilize reduce erosion potential

The OWNER shall decommission new transmission line roads on NFSL after removal of transmission line. OWNER shall be responsible for implementing one or more of the following measures on new roads on NFSL to minimize the effects on other resources:

- Conducting noxious weed surveys and performing necessary weed treatments prior to decommissioning
- Removing any remaining culverts and removing or bypassing relief pipes as necessary
- Stabilizing fill slopes
- Fully obliterating road prism by restoring natural slope and contour; restoring all watercourses to natural channels and floodplains
- Revegetating road prism
- Installing water bars or outsloping the road prism
- Removing unstable fills

On private lands the same measures shall be applied unless the certificate holder contracts with the landowner for revegetation or reclamation as allowed under ARM 17.20.1902.

Appendix E: Cultural Resources Protection and Mitigation Plan

The final Cultural Resources Protection and Mitigation Plan will be incorporated into these specifications.

Appendix F: Vegetation Removal and Disposition Plan

As part of final design, MMC shall prepare a Vegetation Removal and Disposition Plan for lead agency review and approval. One of the plan's goals will be to minimize vegetation clearing. The plan will identify areas where clearing will be avoided, such as deep valleys with high line clearance, and measures that will be implemented to minimize clearing. For example, the growth factor used to assess which trees wo;; require clearing could be reduced in sensitive areas, such as RHCAs, from 15 years to 5 to 8 years. The plan also will evaluate the potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during life of the line. The Vegetation Removal and Disposition Plan will be part of and incorporate details of the final design for the transmission line.

Appendix G: Variations in Right-of-Way Width

DEQ does not recommend specific widths for construction easements. In accordance with the specifications, construction activities shall be contained in the minimum area necessary for safe and prudent construction and approved by the FS on NFSL.

DEQ does not recommend specific variations in right-of-way widths beyond those required to meet the National Electric Safety Code for electric transmission line operations and those necessary to meet standards established in ARM 17.20.1607 (2).

Appendix H: Monitoring Plan

The STATE INSPECTOR is responsible for implementing this monitoring plan required by 75-20-303(b) and (c), MCA, and for reporting whether terms of the Certificate and Environmental Specifications (including but not limited to adequacy of erosion controls, successful seed germination, and areas where weed control is necessary) are being met, along with any conditions in the MPDES General Permit for Storm Water Discharges Associated with Construction Activity and Authorization associated with the transmission line. Additional mitigating measures may be identified by the STATE INSPECTOR or by the KNF INSPECTOR on NFSL in order to minimize environmental damage due to unique circumstances that arise during construction.

In addition to participating in preconstruction conferences, the INSPECTORS shall conduct on-site inspections during the period of construction. At a minimum the INSPECTORS will be present at the start of construction and during the initiation of construction in sensitive areas. Subsequently INSPECTORS shall strive to conduct on-site reviews of construction activities on at least a weekly schedule. More frequent monitoring may be necessary.

INSPECTORS shall record the dates of inspection, areas inspected, and instances where construction activities are not in conformance with Environmental Specifications or terms and conditions of the Certificate of Compliance for the project. Inspection reports shall be submitted in a timely manner to the OWNER's Liaison who will see that corrections are made or that such measures are implemented in a timely manner.

When violations of the Certificate are identified, the STATE INSPECTOR shall report the violation in writing to the OWNER, who shall immediately take corrective action. If violations continue, civil penalties described in 75-20-408, MCA may be imposed. In the event that the KNF INSPECTOR shows reasonable cause that compliance with the Plan of Operations is not being achieved, FS will implement measures described in 36 CFR 228.7(b).

Upon the completion of construction in an area, the INSPECTORS will determine that Environmental Specifications have been followed, and that activities described in Appendix M have been completed and vegetation is progressing in a satisfactory manner.

In the event the DEQ or FS finds that the OWNER is not correcting damage created during construction in a satisfactory manner or that initial revegetation is not progressing satisfactorily, DEQ may determine the amount and disposition of all or a portion of the reclamation bond to correct any damage that has not been corrected by the certificate holder.

Appendix I: Areas Where Construction Timing Restrictions Apply

Restrictions in the timing of tree removal are required on NFSL between April 15 and July 15 around nesting sites of the flammulated owl, black-backed woodpecker, or northern goshawk to assure compliance with the Migratory Bird Treaty Act and FS requirements. The OWNER will be required to complete surveys of the alignment to identify where timing restriction may be required. If surveys conducted one nesting season prior to construction activities does not find nesting of these species, such restrictions shall be rescinded. If surveys located nesting of these species, tree removal restrictions in an avoidance area appropriate for each species shall be in place during the nesting period until the young are fledged.

Restrictions in the timing of tree removal and other transmission line construction activities are required on all lands between February 1 and August 15 around bald eagle breeding sites to assure compliance with the Montana Bald Eagle Management Plan, Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act and FS requirements. Surveys for the bald eagle shall be completed on appropriate habitat.

If an active nest was found, guidelines from the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 1994) will be followed to provide management guidance for the immediate nest site area (Zone 1), the primary use area (Zone 2), and the home range area (Zone 3). This includes delineating a ¼-mile buffer zone for the nest site area, along with a ½-mile buffer zone for the primary use area. High intensity activities, such as heavy equipment use, are not be permitted during the nesting season (February 1 to August 15) within these two zones. The Montana Bald Eagle Working Group recommendations apply during the 5-Year period following delisting of the bald eagle from the list of threatened and endangered species. If the Montana Bald Eagle Working Group recommendations lapse before the line is constructed, then the timing restrictions will revert to the National Bald Eagle Management Guidelines made by the US Fish and Wildlife Service in May 2007.

Restrictions in the timing of transmission line construction activities in elk, white-tailed deer, or moose winter range are required between December 1 and April 30. These timing restrictions may be waived in mild winters if it can be demonstrated that snow conditions are not limiting the ability of these species to move freely throughout their range. The OWNER must receive a written waiver of these timing restrictions from the KNF, DEQ, and FWP, before conducting construction activities on elk, white-tailed deer, or moose winter range between December 1 and April 30. Timing restrictions will not apply to substation construction.

Culvert or bridge installation is prohibited in areas of important fish spawning beds identified in Appendix A and during specified fish spawning seasons on less sensitive streams or

rivers. Riprap or other erosion control activities on NFSL affecting bull trout spawning habitat can only occur during May 15 and September 1.

Other timing restrictions as negotiated by LANDOWNERS in individual easement agreements shall be incorporated into these specifications.

Appendix J: Aeronautical Hazard Markings

DEQ does not recommend aeronautical hazard markings at this time. If a potential hazard is identified during final design, DEQ will consult with the Federal Aviation Administration and Montana Aeronautics Division of MDT to determine appropriate action or aeronautical safety marking.

Appendix K: Weed Control Plan

The final Weed Control Plan will be incorporated into these specifications.

Appendix L: Fire Prevention Plan

The final Fire Prevention Plan will be incorporated into these specifications.

Appendix M: Reclamation and Revegetation Plan

An interim and final Reclamation and Revegetation Plan will be developed and submitted to DEQ and FS for approval. This plan must, at a minimum, specify seeding mixtures and rates. It must satisfy LANDOWNER wishes, to the extent reasonable, requirements of the MPDES General Permit for Storm Water Discharges Associated with Construction Activity, and ARM 17.20.1902(10).

Because the reclamation of construction activities associated with the transmission line is considered interim and final reclamation will be required at mine closure, the primary objective of the interim reclamation plan is to provide long-term stability and control weed infestation during the operational phase of the project. The standards for interim reclamation used to determine construction bond release or to determine that expenditure of the reclamation bond is necessary to meet the requirements of the certificate for transmission lines will follow these primary objectives. MMC shall complete the following activities prior to release of the TRANSMISSION LINE CONSTRUCTION BOND:

- Implementation of the Weed Control Plan (Appendix K)
- Completion of all monitoring and mitigation described in the Cultural Resources Protection and Mitigation Plan (Appendix E)

- Completion of all interim reclamation activities described in the Reclamation and Revegetation Plan (Appendix M)
- Completion of all activities associated with roads used for transmission line construction described in the Road Management Plan (Appendix D)
- Completion of all activities associated with vegetation removal and disposal for transmission line construction described in the Vegetation Removal and Disposition Plan (Appendix F)
- Revegetation is proceeding satisfactorily.

Appendix N: Abandoning and Decommissioning Plan

Prior to the start of construction, the OWNER shall submit to the lead agencies for their approval an abandonment and decommissioning plan. Based on this plan, the agencies will then calculate the amount of the final reclamation bond.

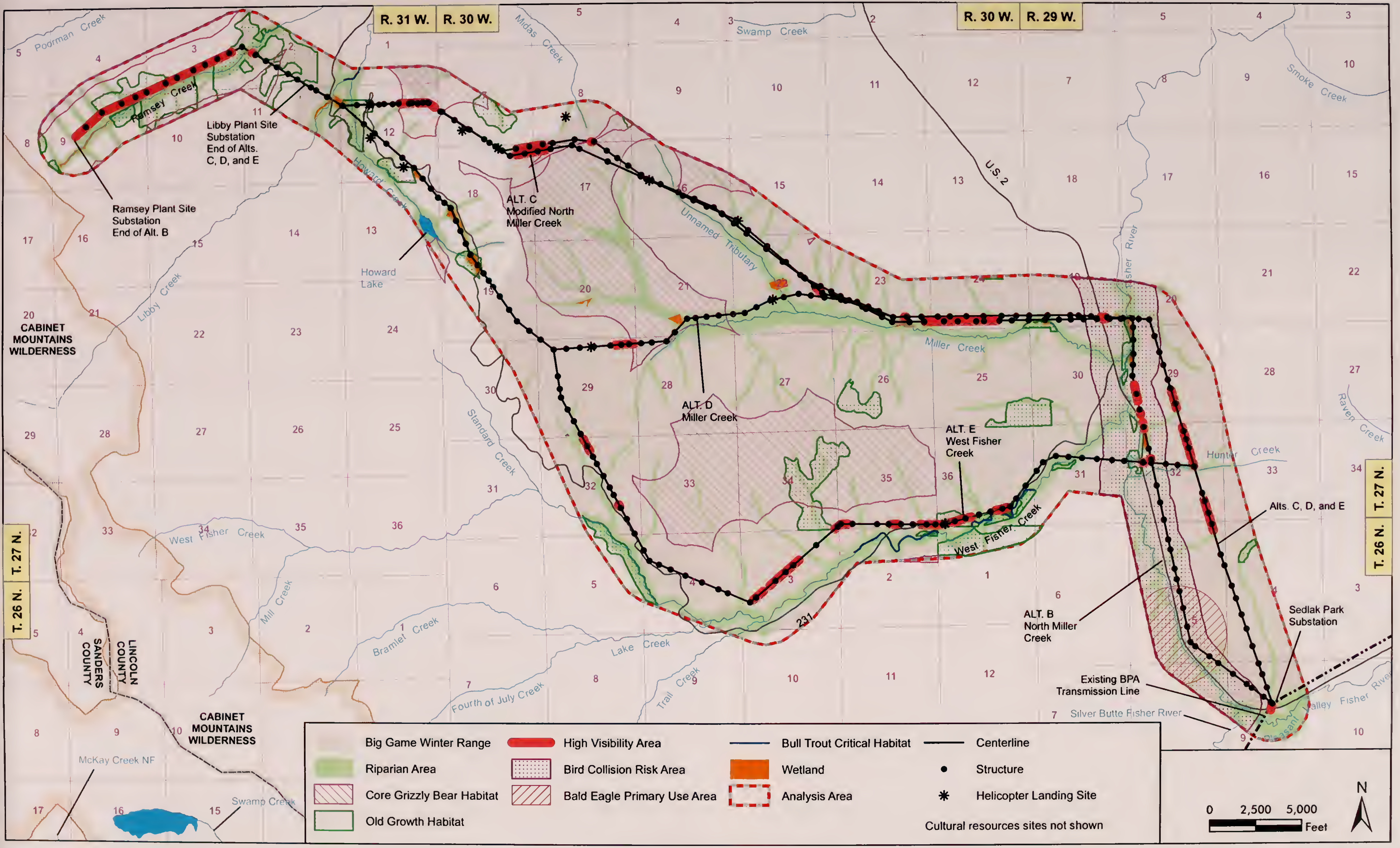

Figure D-1. Sensitive Areas Along Transmission Line Corridors

Appendix E—Past and Current Actions Catalog for the Montanore Project

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Firewood Gathering														
Permits	1985		1312 permits											
Permits	1986		1550											
Permits	1987		1369											
Permits	1988		1122											
Permits	1989		1465											
Permits	1990		1405											
Permits	1991		1842											
Permits	1992		1687											
Permits	1993		1794											
Permits	1994		1805											
Permits	1995		1873											
Permits	1996		1942											
Permits	1997		1880											
Permits	1998		1543											
Permits	1999		1544											
Permits	2000		1762											
Permits	2001		1851											
Permits	2002		1775											
Permits	2003		1475											
Permits	2004		1837											
Permits	2005		1634											
Permits	2006		1765											
Because Fuelwood (Firewood) Permits purchased on the Kootenai National Forest may be used anywhere on the Forest, as well as anywhere within the boundaries of Region 1, statistical information regarding gathering locations is impractical to determine.														
Grazing Allotments														
Swede Mountain	1956-1971	USFS	1500 Acres				X							
McMillan	1956-1971	USFS	200 Acres	X										
McMillan	1956-1971	PVT	300 Acres	X										
Granite-Cherry	1956-1986	USFS	4000 Acres				X							
Granite-Cherry	1956-1986	USFS	2000 Acres	X										
Libby Creek	1956-1989	USFS	3900 Acres	X										
Libby Creek	1956-1989	PVT	500 Acres	X										
Libby Creek	1956-1989	State of MT	150 Acres	X										
Barren	1958-1990	USFS	1500 Acres			X								
West Fisher	1956-1971	USFS	600 Acres			X								
West Fisher	1956-1971	St. Regis	300 Acres			X								
Acres within Subunits are approximate.														

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Mineral Activities														
Gravel pit D5-30/ **active**/Miller Creek Pit	1994–present minimum	NFS lands	0.5 acre			X								
Rock quarry D5-35/ **active**/Miller Creek quarry	1994–present minimum	NFS lands	0.5 acre			X								
Gravel pit D5-14/ **active**/West Fisher River pit	1994–present minimum	NFS lands	0.5 acre			X				X				
Rock quarry D6-49/ **active**/Silver Butte Fisher quarry	1994–present minimum	NFS lands	0.1 acre			X								
Gravel pit D6-50/ active/Silver Butte Fisher pit	1994–present minimum	NFS lands	0.1 acre			X								
Gloria (Little Annie), West Fisher Creek	1930s 2001 last POO/adit closures completed 2007	NFS lands	40 acres active claim/surface disturbance less than 5 acres/mine road 1.5 miles			X				X				
Blacktail lode (aka Jumbo, Tip Top) claim – explore/ secure adits, Bramlett Creek	1909–1939 active inderground mine **Active POO 1993 – present**/minor activities/adit closures planned 2008	NFS lands	40 acres claimed/ surface disturbance less than 5 acres/road to mine approx 1 mile			X				X				
Viking lode Inactive mine, Silver Butte Creek/aka Gold Hill	1934–1940s inactive mine/mill/tram – active claim held, possible adit closures 2008/POO 1993–1995	NFS lands	20 acres active claim/surface disturbance mine road (approx 2 miles), trails, millsite, collapsed stopes, 5-8 acres			X								
A-Far Placer Silver Butte Creek (near Viking) – placer exploration/suction dredge POO	Proposed instream Suction dredge/placer exploration Pits/ **2007/08 analysis, possible 2008 implement**	NFS lands	Less than 2 acres surface disturbance on one placer claim			S								
Gold Hill – ***see Viking***														
American Kootenai Mine, W. Fisher (Bakie)	1890s–1906 active claims adjacent to private/one portal on claim – closure 2008/POO 1998	NFS lands	Less than 5 acres disturbance/mine road 1/2 mile			X				X				
American Kootenai claim group, West Fisher Creek	1890s–1906 patented group includes remnant of mill adj. to upper West Fisher Creek	PVT	162-acre parcel			X				X				
Mother Lode prospect (area of Gloria or Wayup) headwaters of West Fisher Creek	1915	NFS Lands	One adit 160 feet long			X				X				

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Wayup lode claim/inactive/ motorized access in litigation (C. Harpole), W. Fisher	1902–1910/1937–1949 underground mine/several open portals	PVT	26 parcel/use of road behind gate approx 2 miles			X				X				
Branagan lode claim/inactive	1901–1905/1940–1950 mill/ underground workings	PVT	113-acre parcel			X				X				
Irish Boy (Rambler) lode claim/inactive/currently analyzing motorized access request	1930s mine/ **analyzing access 2008**	PVT	30-acre parcel/ minor surface disturbances overgrown			X				X				
Fourth of July lode claim/inactive/access analyzed 1990s/in litigation (H. Skranak), Bramlett Creek	1960s motorized access in litigation late 1990s through 2008	PVT	29-acre parcel			X				X				
King Mine lode claim/inactive	Early 1900s–1950 – site of mill and underground workings	PVT	200-acre parcel			X								
Golden West (New Mine) lode claim/abandoned mine, West Fisher Creek	1940s – shallow adits/tram/closures planned for 2008	NFS lands	40 acres(?) claimed/less than 5 acres surface disturbance			X				X				
Union	Pre-1955 – millsite between Branlet and Mill Creek (tribs of West Fisher Creek)	PVT	Unknown			X				X				
Hannagan (Libby Prospect)	Pre-1948; aka Libby. West of Jumbo; caved adits; West Fisher Creek (part of American Kootenai private parcel)	PVT	Unknown			X				X				
Libby prospect – ***see Hannagan***	Hannagan	PVT	Unknown			X								
Mustang Mine ,Standard Creek	1930s–2003 intermittent Last POO 2003/reclaimed 2003	NFS lands	200 acres claimed/ surface disturbances reclaimed, portal closed			X				X				
Williams, Standard Creek	Pre-1948 – adits/cuts between Great Northern and Twin Peaks	NFS lands	Claim status – closed/minor surface disturbances			X				X				
Midas Mine, Standard Creek	1905–1948 extensive underground workings and mill/Standard Creek drainage	PVT	60-acre parcel			X				X				
Midas Mine lode claim inactive, Standard Creek	POO – 1989–1990 on 3 adits near W. edge of private land–AC Lewis caved portals	NFS lands	520 acres claimed/ less than 5 acres surface disturbance			X				X				

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Montezuma prospect (aka Silver Tip) /inactive – West Fisher Creek	1950s – shallow adits, pits, trenches, inactive (2 miles southeast of Midas mine) east side of West Fisher Creek. POO 1976–1992 (G.Shaw) Reclaimed 1993	NFS lands	20 acres (?) inactive claims/ surface disturbances (cabin site, prospects) reclaimed			X				X				
Silvertip-Lead prospect(part of Snowshoe group) between Big Cherry and Snowshoe creeks, above Cherry Creek Trail	Pre-1926	NFS lands	Pits, short adits/ less than 5 acres surface disturbance	X										
Miller Placer prospect/inactive – West Fisher Creek	1930s – one inaccessible shaft along West Fisher Creek, 2 miles S. of Teeters Peak	NFS lands	40 acres (?) claimed/minor surface disturbances			X				X				
Waylett Placer	1919 – lower Lyons Creek, trib. of Vermillion Creek east of Trout Creek, MT	NFS lands	Unknown											
Waylett group (aka Moose Hill, Royal) inactive-prospecting and reclamation aka Seclusion (AC Lewis) Miller Creek	1905–1960 prospect 1/2 mile SE of Midas Mine, Miller Creek near Teeters Peak/tungsten-qtz veins 1977 active; 1999 reclaimed POO – 1989–1998 (A.C. Lewis)	NFS lands	20 acres (?) inactive claims/ caved portals/ surface disturbances reclaimed			X				X				
Waylett North prospects	Pre-1948 – prospect east of Midas Mine	NFS lands	Claim status – closed/surface disturbances unknown			X				X				
Seclusion – ***see Waylett***						X								
Standard Lake area active lode claims	No POO/No activity	NFS lands	100 acres claimed/ no surface disturbances			X				X				
Sunrise prospect, near Silver Butte Pass (Rankin claims)	No POO	NFS lands	Unknown			X								
Silver Butte (NFS lands portion of King Mine)	No POO	NFS lands	40 acres closed claims/caved portals			X								
Snowfall Prospect – near Silver Butte Pass	No POO	NFS lands	1950s – 1.5 miles SE of King mine; 2 or more caved adits,disturbance unknown			X								
Illinois Montana group – ***see Bear Lakes***		NFS lands				X								

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Bear Lakes	**2005 EA – trail construction (implement date unknown)**	PVT	85-acre parcel/site of private cabin			X				X				
Bear Lakes mining claims adjacent to private land – no activity (aka Illinois Montana)	No POO	NFS lands	20 acres claimed/ unknown surface disturbances			X				X				
Silver Tip – ***see Montezuma***		NFS lands												
Gravel pit D5 – 22/ reclamation/ Leigh Creek pit	Inactive since early/mid-1980s	NFS lands	0.25 acre	X										
Gravel pit D5 – 26/ reclamation/Libby Creek Pit	Active prior to 1994	NFS lands	0.3 acre	X										
Rock Quarry/D5 – 31/status pending/Crazyman Quarry	Active prior to 1994	NFS lands	0.25 acre	X					X					
Gravel Pit D5 – 39/ active/Little Cherry Pit	Active since between 1994–1999	NFS lands	1 acre?	X					X					
Gravel Pit D5 –13/ active/Poorman Creek Pit	Active prior to 1994	NFS lands	2 acres	X					X					
Seattle (leased to St. Paul Lead Co., Big Cherry Creek/ prospect	1958–1964	NFS lands	Cuts, pits, caved adits	X										
Snowshoe Mine – inactive mine	1890s–1964 underground mine and surface facilities	PVT	4 lode claims – approx 80 acres/ appprox 25 acres surface disturbances being reclaimed	X										
Snowshoe Mine **CERCLA** clean-up site	**2007–2009 tailings removal, adit closures, stream reconstruction**	PVT	25 acres approx 180,000 cy tailings	X										
Snowshoe Mine Tailings along Snowshoe Creek/ **CERCLA clean-up site**	**2007–2009 tailings removal**	NFS lands	Approx 17,000 cy tailings/approx 2 acres	X										
Snowshoe CERCLA tailings "mixed tailings" **repository site**	Timber Cleared 2006/ **construction 2007/ place tailings 2008, complete reveg 2009**	NFS lands	17 acres distrubed	X										
Zollars aka St. Paul (Oro Mining, Silver Star Mine) claims contiguous with Snowshoe group – ***see Raven (Shaw)***				X										
Texas Ranger group – ***see Snowshoe Mine***				X										

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Alpine Claim/Montana Silver-Lead/Big Sky Mining – Leigh Creek (near trailhead)	1897 located; 1915–1950s active; adits on steep slope/1994 proposal, no POO	NFS lands	Sloughed, overgrown, unknown	X										
Big Sky – ***see Alpine/ Montana Silver-Lead***				X										
Big Cherry Millsite	1950s	NFS lands	Approx 10 acres – mill and tailings ponds	X										
Big Cherry Millsite CERCLA tailings clean-up and repository construction	June–Oct. 2007 complete	NFS lands	Approx 15–20 acres millsite and repository and 5 acres of tailings along Big Cherry Creek	X										
Halfmoon – prospect on Poorman Creek side of Cable Mountain	1960s	NFS lands	Short tunnel, pits/ minor surface disturbance	X					X					
Cableway group – prospect	Unknown	NFS lands	Overgrown, unknown	X					X					
Statesman prospect – north side of Poorman Creek	Unknown	NFS lands	Shallow cuts; unknown	X					X					
John Bill – Uncle Sam inactive	Near Cable/Bear confluence	NFS lands	Collapsed adit, overgrown, minor surface disturbance	X					X					
Silver Cable Prospect/Mill (no production) Cable Creek	1930s	PVT	160 acre approx parcel size/one shallow open adit/use of approx 3 miles of road behind gate	X					X					
Silver Cable area unpatented claims (Wilbe claims Johnson/Prokop) Cable Creek	**1993–present POO for access only** (claim assessment work only) using road behind gate	NFS lands	One shallow adit/ less than 5 acres surface disturbance/use of approx 2 miles road use behind gate	X					X					
Montanore (formerly Johnstone Placer patented claim) adit Libby Creek	**Active 1989–1995 and 2006–present/ EA for road use 2008**	PVT	Portal and surface facilities on approx 20 acres (89 acres total claimed in area)	X					X					

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Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Betty Mae prospect upper Libby Creek	Pre-1948 – shallow lode prospects, upper Libby Creek	NFS lands	Caved adits/minor surface disturbance	X						X				
Diamond John prospect, north side of upper Libby Creek	Pre-1948 adit	NFS lands	1 adit – 60 feet long	X					X					
Lost Grouse (aka Skranak, Bolyard Placer, or Vaughn and Greenwell) Libby Creek	Mining – intermittent 1890s–1995/ POO 1992,95,96; Lost Grouse reclamation planned 2008	NFS lands	Claim approx 20 acres/less than 5 acres surface disturbance, drillhole/mine road 1/2 mile	X					X					
AUMCO (Peterson) instream suction dredge in Libby Creek	**POO – 1979–present**	NFS lands	3 placer claims/ instream only; use of 6199 Rd behind gate approx 2 miles	X										
ALPINE PLACER instream suction dredge in Libby Creek/dry placer exploration (Logan Pit) (B. Ericksmoen)	**Suction dredge POO 1990–present /Logan Pit – 1914–1930s historic mining with POO 1982–present**	NFS lands	2 placer claims/ surface disturbance Logan Pit less than 5 acres/use of 6199 Rd behind gate approx 2.5 miles	X										
BACK ACRES (GPAA/ Taylor) instream suction dredge (formerly Ford Wilson placer)	**Active POO 3 years 2004–present/prior activity pits near bank POO 1993-2001**	NFS lands	1 placer claim/pits less than 5 acres disturbance	X										
CRAZYMAN instream suction dredge (inactive) aka Getner Placer	POO 1993–2005	NFS lands	2 active placer claims/instream, less than 1 acre on bank-access	X										
Getner Placer – ***see Crazyman***				X										
NWMGPA – Ace Placer Exploration	**Mid-1990s–present POO**	NFS lands	Less than 5 acres disturbance (pits), road approx 1/2 mile	X					X					
NWMGPA – LJ claims instream suction dredge	**Mid-1990s–present POO**	NFS lands	7 claims/instream only	X					X					
NWMGPA – Bent/99rs claims trenching; Big Cherry Creek	**POO 2005–2006 pits/reclaimed**	NFS lands	Reclaimed	X										

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Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
NWMGPA – Bent/99rs Claims – instream suction dredge Cherry Creek (includes Howard Placer active prior to 1955 (1929–1932)	1929–1932, 1955 – area active/**POO 1993–present**	NFS lands	2 claims/instream only	X										
Harry Howard Placer – ***see NWMGPA Bent/99rs***				X										
LUCKY STRIKE instream suction dredge (previously L-Oro claims)	**1992–present POO**	NFS lands	Approx 500 feet of stream within 1 placer claim, instream only	X										
Nugget Placer (Beckstrom)	**1929–1932 hydraulic mining/POO for access on 6199 Rd behind gate 1981–2004**	NFS lands	Instream panning/access on approx 2.5 miles road behind gate	X										
Zahav I – instream suction dredge proposal (formerly Viona) at Bear/Libby Creek confluence/historic mining area, adjacent to Nugget	**2007 proposed POO received; 2008 analysis for suction dredging and access; implement 2008 or 2009/previous POO 1999–2006**	NFS lands	1 placer claim, instream only/use of road behind gate 6199 Rd approx 2 miles	X										
Libby Creek Ventures (Bakie) Libby Creek	**POO exploration drilling Jan. 2006–Oct. 2008**	NFS lands	Proposed disturbance along Libby Creek Road less than 1/2 mile/no activity under POO as of Jan. 2008	X					X					
MYTEE FINE Placer – instream suction-dredge	New proposal in 2006 – **analysis completed in 2007 POO signed 2007 possible June 2008 implement**	NFS lands	Approx 500 feet of stream within 1 placer claim	X					X					
MYTEE FINE Placer – exploration pits and temp road	**POO Sept. 2007–Oct. 2009**	NFS lands	Less than 5 acres to disturb includes temp road	X					X					
GOOD MEDICINE PLACER exploration pits (Jungst), formerly Dreamdust	**Proposal for 2008 in analysis – possible June 2008 implement/previous POO 1996–2005, 2007**	NFS lands	Less than 5 acres distrurbance	X					X					
Raven (aka St. Paul or Zollars Saint Paul Group) (above Snowshoe Creek – D. Shaw) underground mine & prospects	1955–? Adit closure – 2008 or 2009; POO 1990–1992	NFS lands	Approx 60 acres claimed/3 open adits, waste rock, mine road approx 2,000 feet	X										

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Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Silvertip (above Cherry Creek)	1926–?	NFS lands	Approx 60 acres of claims/portals, waste rock, less than 5 acres	X										
Libby Creek Recreational Gold Panning Area/primitive camp	Site of historic mining early 1900s–1950s/late 1980s'land exchanged to NFS lands for rec. uses	NFS lands	Land designated for this purpose amounts to approx 175 acres	X					X					
Libby Placer Mining Co.–instream placer mining in Libby Creek	1889–1930s/large scale placer mine near 8.2-mile bridge Libby Creek	PVT	Approx 1,200 acre parcel, approx 3 miles of stream	X					X					
Libby Creek Gold Mining Co.	1930s–1940s placer, hydraulic mining Howard Creek, Libby Creek above Howard Creek confluence	NFS lands	Unknown	X					X					
Bolyard Placer – ***see Vaughn/Greenwell, Lost Grouse***, upper Libby Creek – connected to Lost Grouse	1889–1909; 1964 hydraulic mining, sluicing/small scale drifting/POO 1992, 1995, 1996/ **reclamation planned 2008 on Lost Grouse**	NFS lands	Underground workings intercepted by Lost Grouse in 2001 on less than 5-acre disturbance	X					X					
Copper-Iron occurrence	Unknown	NFS lands	Unknown	X										
Copper-lead-iron-manganese occurrence	Unknown	NFS lands	Unknown											
Copper Reward (aka Walker Group or Walker Tunnel) – prospect	Unknown	NFS lands	Caved adits above slope on Big Cherry Creek trail/ less than 5 acres disturbance	X										
Walker – ***see Copper Reward***														
Fairbuilt prospect	Unknown	NFS lands	One adit 335 feet; status unknown	X					X					
Comet Placer – instream placer mining (aka Deadwood/Hogun)/Noranda Minerals/MMI	1908–1916/1931 hydraulic mining near mouth of Little Cherry Creek	PVT	Site of hydraulic mining; approx 350 acres in patented claims	X					X					
Red Gulch Placer (part of Comet) – ***see Comet Placer***		PVT												
Grizzly/Missouri/McDonald on Leigh Creek near bridge and just above confluence with Big Cherry Creek	Pre-1948 adits/closures planned 2008 or 2009	NFS lands	3 (?) adits/minor surface disturbances, overgrown	X										
Glacier Silver/Lead aka Lukins/Hazel Mine – **currently being subdivided**	1910–1964, extensive underground mine, mill/**subdivision planned-date unknown**	PVT	Approx 700 acres/ 10,500 feet of workings, site of 325 T/day mill				X							

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				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Loyal – ***see Luken Hazel*** (aka Shaughnessy Hill)		PVT					X							
Double Mac, north side Granite Creek near Victor Empire – prospect	Early 1900s	NFS lands	2 short caved adits/minor surface disturbance				X							
Victor Empire (north side of Granite Creek near trailhead) inactive – mining, milling	1908–1937/**adit closure complete 2007**	NFS lands	200 acres of mining claims, surface disturbances overgrown				X							
Silver Mountain Mine (south side Granite Creek)	1910–1950s/mill, flume, 3 adits, lower one open, **adit closure planned 2008**	NFS lands	Approx 150 acres of claims/surface disturbance less than 5 acres				X							
Mountain Rose aka Granite Creek (south side Granite Creek) see Silver Mountain		NFS lands					X							
Prospect Hill Mineral Exploration (explore existing portal)	**In analysis – POO due winter 2008**/Herbert mine – 1930s/Orvana POO exploration 1990–1998	NFS lands	20-acre claim/less than 5 acres surface disturbance for minerals exploration/use/ minor reconstruct. of mine road .5 mile, approx less than 1 mile road construction				X	X						
Prospect Hill Private land access – easement and road construction	**In analysis – Special Use permit spring 2008**	PVT	20-acre parcel; less than 1 mile road construction to access; use/minor reconstruct. of mine road, approx .5 mile				X	X						
D&W group – inactive/ prospect	1930s adits on south side of Prospect Creek includes Ida V. and pits	NFS lands	Caved adits/less than 5 acres/ mining claim inactive				X							
Demonstrator Prospect	1930s	NFS lands	Small cuts – minor disturbance near Herbert Mine				X							
Denver #1 and #2	1930s	NFS lands	Pits, minor, near Herbert Mine				X							

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				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Gravel pit D5-8/in reclamation status/Prospect Creek Pit	Inactive since mid-1980s ? at least – reclamation status	NFS lands	0.25 acre				X							
Gravel pit D5-21 – Deep-Granite pit reclamation status	Inactive since mid-1980s ? at least – reclamation status	NFS lands	0.1 acre				X							
Gravel pit D5-12/Big Cherry Creek Pit/**Active** status	**Active** at least since prior to 1994	NFS lands	2.5 acres				X							
Gravel pit D5-7/Deep Creek Pit/reclamation	Inactive at least since mid-1980s	NFS lands	0.5 acre				X							
Noxious Weeds Management														
1997 KNF Herbicide Weed Control Plan EA	2002	USFS	Acres	28.25		5.25	12.5							
1997 KNF Herbicide Weed Control Plan EA	2003	USFS	Acres	67.25		22.75	4.5							
1997 KNF Herbicide Weed Control Plan EA	2004	USFS	Acres	47.5		32.75	156							
1997 KNF Herbicide Weed Control Plan EA	2005	USFS	Acres	82.3		39.27	7							
1997 KNF Herbicide Weed Control Plan EA	2006	USFS	Acres	51.3		93.7	24.1							
KNF Herbicide Weed Control Plan EA 2002	2002	USFS	Acres sprayed		62									
KNF Herbicide Weed Control Plan EA 2002	2003	USFS	Acres sprayed		0									
KNF Herbicide Weed Control Plan EA 2002	2004	USFS	Acres sprayed		10									
KNF Herbicide Weed Control Plan EA 2002	2005	USFS	Acres sprayed		4									
KNF Herbicide Weed Control Plan EA 2002	2006	USFS	Acres sprayed		10.5									
Pre-cummercial Thinning														
Pre-commercial Thin	1950s	FS	0 ACRES	X										
Pre-commercial Thin	1960s		79	X										
Pre-commercial Thin	1970s		557	X										
Pre-commercial Thin	1980s		597	X										
Pre-commercial Thin	1990s		1713	X										
Pre-commercial Thin	2000-2006		403	X										
Pre-commercial Thin	1950s	FS	0			X								
Pre-commercial Thin	1960s		980			X								
Pre-commercial Thin	1970s		312			X								
Pre-commercial Thin	1980s		152			X								
Pre-commercial Thin	1990s		51			X								
Pre-commercial Thin	2000-2006		0			X								
Pre-commercial Thin	1950s	FS	0				X							
Pre-commercial Thin	1960s		502				X							

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Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Pre-commercial Thin	1970s		1083				X							
Pre-commercial Thin	1980s		264				X							
Pre-commercial Thin	1990s		891				X							
Pre-commercial Thin	2000-2006		271				X							
Prescribed Burning														
Fuels Treatment	1950s	FS	0	X										
Fuels Treatment	1960s		6	X										
Fuels Treatment	1970s		1455	X										
Fuels Treatment	1980s		799	X										
Fuels Treatment	1990s		760	X										
Fuels Treatment	2000-2006		0	X										
Fuels Treatment	1950s	FS	0			X								
Fuels Treatment	1960s		0			X								
Fuels Treatment	1970s		0			X								
Fuels Treatment	1980s		255			X								
Fuels Treatment	1990s		129			X								
Fuels Treatment	2000-2006		0			X								
Fuels Treatment	1950s	FS	0				X							
Fuels Treatment	1960s		00				X							
Fuels Treatment	1970s		75				X							
Fuels Treatment	1980s		258				X							
Fuels Treatment	1990s		275				X							
Fuels Treatment	2000-2006		130				X							
Recreational Building Maintenance														
Toilets		FS		2	7	2	1							
Pavillion		FS			2		1							
Pump House		FS		1										
Storage Shed		FS		1										
Lookout Tower		FS				1	1							
Old Cabin		FS				1								
Radio Buildings		Non-FS				1	1							
Many Private Buildings in all 4 Planning Subunits. Several buildings associated with old mining claims.														
Road Construction, Maintenance, and Obliteration														
Silver Butte Phase RAC 2	2007	FS	7.5 miles			X								
West Fisher Aggregate Placement	2007	FS/PC	4.2 miles			X								
Libby Creek Bridge Approach Paving	2007	FS	8 Bridges	X										
West Fisher RAC	2007	FS	1.5 miles			X								
Libby Creek ERFO	2008	FS	Washout site	X										
Big Cherry Millsite Cleanup	2007	FS	Hazmat cleanup site				X							
Snowshoe Cleanup	2008	State/Private	Hazmat cleanup site	X										

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				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Big Cherry Bridge ERFO	2007	FS	1 Bridge Repair from flood				X							
Midas Creek Fish Passage	2007	FS	Culvert replacement	X										
Rd 6205 BMP	2007	FS	BMP work on 1 mile	X										
NF Bull River ERFO	2007	FS	Washout site		X									
SF Bull River ERFO	2007	FS	Washout site		X									
Routine Road Mtce is likely to occur on many of the roads	Annually	FS		X	X	X	X							
Routine road maintenance is likely to occur on open roads in Silverfish subunit (Miller West Fisher EIS).														
Special Forest Products														
Huckleberry gathering sesonal commercial permit	2002	FS	Unknown	X	X	X	X	X	X	X				
Huckleberry gathering sesonal commercial permit	2005	FS	Unknown	X	X	X	X	X	X	X				
Special Use Permits														
FRTA Road – PCTC 401371	1982		8.0 ac.			X								
FRTA Road – PCTC 401373	1983		4.67 ac.			X								
FRTA Road – PCTC 497813	1965		22.0 ac.			X								
FRTA Road – PCTC 497817	1964		12.29 ac			X								
FRTA Road – PCTC 401727	1979		12.08 ac.			X								
FRTA Road – PCTC 497860	1982		46.0 ac.			X								
FRTA Road – PCTC 497861	1982		1.52 ac.			X								
THR074 – Sp. Use Road	1994		0.14 ac.				X							
CAB062 – Water Qlty Station - Monitoring	1993		1 – Permit		X									
496801 – FRTA Road	1986		10.90 ac		X									
495601 – FRTA Road	1986		9.12 ac		X									
095502 – Powerline (BPA)	1950		1 - permit		X									
CAB049 – Sp Use Road	1980		1.61 ac		X									
095506 – Passive Reflector	1977		1 - permit		X									
CAB060 – Sp.Use Road	1980		1.61 ac.		X									
Outfitter & Guide	?		2 -Permit		X									
CAB064 – Water Transmission Pipeline <12"	1992		0.05 ac		X									
CAB048 – Water Transmission Pipeline <12"	1957		0.07 ac		X									
CAB116 - Water Transmission Pipeline <12"	1991		0.10 ac											
496607 – Powerline	1985		91.40 ac.		X									
510401 – FLPMA Easement	1993		0.09 ac		X									
CAB028 – Water Transmission Pipeline <12"	1981		0.41 ac.		X									

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				C	R	S	T	2	5	6	Cabinet Face	C	R	W
CAB111 – FLPMA Easement	2006		0.56 ac		X			X						
KNF006 – FRTA Road	2002		7.85 ac.		X			X						
LIB022 – FRTA Road	2002		112.0 ac.	X			X	X						
LIB094 – Water Conveyance system easement	1927		1.63	X				X						
LIB129 - Water Transmission Pipeline <12"	1963		0.13 ac.	X				X						
507601 – FLPMA Easement	1999		1.65 ac	X				X						
195222 – DOT Easement (2)	1984		130.10	X				X						
LIB135 – Sp Use Road	1996		0.39 ac	X				X						
533601 – Irrigation Water Ditch	1983		2.20 ac.	X				X						
529801 – Sp Use Road	1981		0.63 ac.	X					X					
LIB021 – FRTA Road	2000		3.84 ac.				X							
502201 – FLPMA Easement	1998		0.97 ac				X		X					
511901 – Sp Use Road	1998		3.38 ac.				X		X					
LIB050 – Target Range	1978		12.0 ac				X							
LIB090 – Sp Use Road	1983		1.09 ac				X							
LIB128 – Sp Use Road	1996		0.34 ac.				X		X					
100134 – FRTA Road	1983		8.03 ac				X							
100144 – FRTA Road	1977		0.79 ac				X		X					
100137 – FRTA Road	1981		6.15 ac				X			X				
100138 – FRTA Road	1981		7.84 ac				X			X				
101001 – Water Diversion weir	1986		1.29 ac				X			X				
405706 – Passive Reflector	1966		1 permit				X			X				
300301 – Broadcast Translator/Low Power	1996		1 permit				X			X				
100152 – FRTA Road	1994		8.18 ac.				X			X				
KNF014 – Powerline (BPA)	1950		1 - permit				X			X				
Trail Mtce-Secondary	2004	FS	0.00											
Trail Mtce – Way	2004	FS	22.85 miles			X				X				
Timber Sales														
Regeneration Harvests	1950s	FS	127 Acres	X										
Regeneration Harvests	1960s		1220	X										
Regeneration Harvests	1970s		3501	X										
Regeneration Harvests	1980s		2244	X										
Regeneration Harvests	1990s		826	X										
Regeneration Harvests	2000-2006		27	X										
Intermediate Harvests	1950s	FS	56 Acres	X										
Intermediate Harvests	1960s		608	X										
Intermediate Harvests	1970s		1312	X										
Intermediate Harvests	1980s		879	X										
Intermediate Harvests	1990s		850	X										

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				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Intermediate Harvests	2000-2006		33	X										
All PVT Harvests	1950s	Private	509 Acres	X										
All PVT Harvests	1960s		139	X										
All PVT Harvests	1970s		204	X										
All PVT Harvests	1980s		1052	X										
All PVT Harvests	1990s		1295	X										
All PVT Harvests.	2000-2006		232	X										
Sum PVT Regen.			1617 Acres	X										
Sum PVT Intermed.			1814 Acres	X										
Regeneration Harvests	1950s	FS	Acres			X								
Regeneration Harvests	1960s		47			X								
Regeneration Harvests	1970s		97			X								
Regeneration Harvests	1980s		1004			X								
Regeneration Harvests	1990s		170			X								
Regeneration Harvests	2000-2006		0			X								
Intermediate Harvests	1950s	FS	0 Acres			X								
Intermediate Harvests	1960s		1549			X								
Intermediate Harvests	1970s		647			X								
Intermediate Harvests	1980s		536			X								
Intermediate Harvests	1990s	FS	384			X								
Intermediate Harvests	2000-2006		0			X								
All PVT Harvests	1950s	PVT	41 Acres			X								
All PVT Harvests	1960s		0			X								
All PVT Harvests	1970s		0			X								
All PVT Harvests	1980s		2561			X								
I All PVT Harvests	1990s		426			X								
	2000-2006		566			X								
Sum PVT Regen			1808			X								
Sum PVT Intermed.			1786			X								
Regeneration Harvests	1950s	FS	0				X							
Regeneration Harvests	1960s		499				X							
Regeneration Harvests	1970s		379				X							
Regeneration Harvests	1980s		1502				X							
Regeneration Harvests	1990s		1221				X							
Regeneration Harvests	2000-2006		27											
IntermediateHarvests	1950s	FS	0 Acres				X							
IntermediateHarvests	1960s		105											
IntermediateHarvests	1970s		21											
IntermediateHarvests	1980s		579											
IntermediateHarvests	1990s	FS	686				X							
IntermediateHarvests	2000-2006		567											
All PVT Harvests	1950s	PVT	0 Acres				X							
All PVT Harvests	1960s		488				X							
All PVT Harvests	1970s		708				X							

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
All PVT Harvests	1980s		3196				X							
All PVT Harvests	1990s		1248				X							
All PVT Harvests	2000-2006		615				X							
Sum PVT Regen			3097				X							
Sum PVT Intermed.			3158				X							
BABY BEAR BUGS	1987		111	X										
BARE DOWN FUELWOOD	1996		11	X										
BARE FUEL	1986		27	X										
BEAR-POORMAN WP SALV	1990		86	X										
BEAR??	1982		57	X										
BIG CHERRY	1994		78	X										
BUGGY BEAR PC	1984		37	X										
BUNYAN BUGS	1988		55	X										
BUNYAN PULP	1997		13	X										
CAMPGROUND BUGS	1988		25	X										
CENTRAL PLACER S.T.	1985		45	X										
CRAZY BUGS	1985		20	X										
CRAZY CAB SALV	1998		126	X										
CRAZYMAN BLOWOUT	1982		27	X										
CRAZYMAN BUGS	1987		11	X										
CRAZYMAN SALE	1974		123	X										
CRAZYMAN SALE	1975		156	X										
CRAZYMAN SALE	1976		797	X										
GOLDIELOCKS P C	1986		25	X										
GRANITE	1987		115	X										
GRANITE	1988		184	X										
HOODOO	1982		50	X										
HOODOO	1983		59	X										
HOODOO	1987		186	X										
HOODOO	1988		413	X										
HOODOO	1989		110	X										
HOODOO	1990		412	X										
HOODOO	1991		326	X										
HOODOO	1992		16	X										
HOODOO SALE	1978		12	X										
HORSE BUGGY PC	1984		9	X										
HORSE BUGGY PC	1986		7	X										
HORSE CABLE	1985		198	X										
HORSE CABLE	1986		267	X										
HORSE CABLE	1987		130	X										
HORSE CABLE	1988		171	X										
HORSE CABLE	1989		34	X										
HORSE CABLE CLEANUP	1989		100	X										

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
HORSE CABLE CLEANUP	1991		12	X										
HOWARD W. FISHER	1978		93	X										
HOWARD W. FISHER	1984		38	X										
JUST RIGHT PC	1988		42	X										
LEIGH CR. BUGS	1989		99	X										
LIBBY CR SEED TREE	1989		125	X										
LIBBY CREEK	1973		67	X										
LIBBY CREEK	1976		134	X										
LIBBY CREEK STR	1982		16	X										
LIBBY-HORSE BLOWDOWN	1990		15	X										
LITTLE CHERRY BUG	1989		39	X										
MAMA BEAR BUGS	1987		133	X										
MIDAS	1990		160	X										
MIDAS	1991		258	X										
MIDAS BLOWDOWN	1998		81	X										
MIDAS SEED TREE	1989		194	X										
ONCE MORE SALVAGE	1991		29	X										
PAPA BEAR BUGS	1987		108	X										
PAUL BUNYAN P.C.	1986		81	X										
PAUL BUNYAN P.C.	1987		40	X										
POOR LITTLE RAMSEY	1982		42	X										
SKI TRAIL SALVAGE	1990		12	X										
SKIER DOWN SALV	1997		130	X										
SMEARL LITTLE CHERRY	1970		89	X										
SMEARL LITTLE CHERRY	1976		63	X										
SMEARL LITTLE CHERRY	1978		413	X										
SMEARL LITTLE CHERRY	1980		25	X										
SMEARL LITTLE CHERRY	1981		25	X										
SMEARL LITTLE CHERRY	1982		287	X										
SNOWSHOE	2006		19	X										
SNOWSHOE PLANT BUGS	1991		3	X										
TREASURE 2 (STEWARDS)	2004		22	X										
TREASURE 2 (STEWARDS)	2005		8	X										
WHO DOWN SALVAGE	1993		231	X										
WILLIAMS MCMILLIAN	1981		39	X										
WINDY BEAR SALV	1997		89	X										
CEDAR CR POSTS #1	1992		11				X							
CEDAR CR POSTS #2	1992		16				X							
CEDAR CR POSTS #3	1991		6				X							
DEEP GRANITE	1979		290				X							
DEEP GRANITE	1980		303											

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
FLOWER BUGS	1987		11				X							
FLOWER CEDAR	1980		61				X							
FLOWER CEDAR	1981		114				X							
FLOWER CEDAR	1982		18				X							
FLOWER CEDAR	1984		251				X							
FLOWER CEDAR	1985		85				X							
FLOWER CEDAR	1986		183				X							
FLOWER CEDAR	1988		10				X							
FLOWER-CEDAR ST	1990		55				X							
GOLD DIGGER BUGS	1993		79				X							
GRANITE	1986		75				X							
GRANITE	1987		162				X							
GRANITE	1988		16				X							
GRANITE BRUSH BUGS	1987		24				X							
GRANITE BRUSH BUGS	1990		140				X							
GRANITE BUGS	1986		32				X							
GRANITE CREEK BUGS	1988		102				X							
GUAGING STATION	1982		26				X							
INTAKE BUGS	1989		11				X							
INTAKE BUGS	1990		92				X							
ISOLATED BUGS	1987		20				X							
MAMA BEAR BUGS	1987		31				X							
NO CREEK BUGS	1987		74				X							
NO RESALE	1986		40				X							
NO RESALE	1987		13				X							
PARMENTER BLOWDOWN	1999		61				X							
PARMENTER HILL BUGS	1988		28				X							
PARMENTER TRASPASS	1989		7				X							
PROSPECT PARMENTER	1994		315				X							
PROSPECT PARMENTER	1995		22				X							
PROSPECT PARMENTER	1996		249				X							
PROSPECT PARMENTER	1997		96				X							
PROSPECT PARMENTER	1998		45				X							
PROSPECT PARMENTER	1999		108				X							
PROSPECT PEST 1	1989		12				X							
SCENERY SALVAGE	1997		36				X							
SNOWSHOE PLANT BUGS	1991		172				X							
SNOWSHOE PLANT BUGS	1992		109				X							
SNOWSHOE ROAD BUGS	1990		314				X							
SOUTH FLOWER BUGS	1990		31				X							
TREASURE 1 (STEWARDS	2003		594				X							
WILLIAMS MCMILLAN	1981		54				X							
WILLIAMS MCMILLAN	1982		113				X							

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
CHECKERBOARD LE	1986		17			X								
CHECKERBOARD LE	1987		33			X								
CHECKERBOARD LE	1992		72			X								
CHECKERBOARD LE	1993		81			X								
CHECKERBOARD LE	1994		55			X								
CORRAL SALVAGE	1997		50			X								
CORRAL SALVAGE	1998		50			X								
HORSE CABLE	1987		18			X								
HORSE CABLE	1988		151			X								
HORSE CABLE	1989		139			X								
HORSE CABLE	1990		59			X								
HORSE CABLE	1991		359			X								
HOWARD W. FISHER	1976		61			X								
HOWARD W. FISHER	1977		15			X								
HOWARD W. FISHER	1978		72			X								
HOWARD W. FISHER	1980		12			X								
MIDAS TRESPASS	1993		13			X								
MILLER FIRE SALVAGE	1993		27			X								
MILLER POST & POLE	1987		10			X								
MILLER POST & POLE	1990		9			X								
MILLER POST & POLE	1991		6			X								
MILLER POST & POLE	1992		7			X								
MILLER STUD P.C.	1986		33			X								
RED BATTON PC	1985		143			X								
SWAMP SCHRIEBER	1989		15			X								
TEETERS BUGS P.C.	1985		47			X								
TEETERS BUGS P.C.	1986		15			X								
TEETERS BUGS RS	1985		26			X								
TEETERS BUGS RS	1987		112			X								
TRAIL CR. BLOWDOWN	1987		8			X								
TRAIL CR. BLOWDOWN	1988		71			X								
TRAIL CREEK	1986		287			X								
TRAIL CREEK	1987		14			X								
WEST FISHER	1978		472			X								
WEST FISHER	1980		27			X								
WEST FISHER	1982		162			X								
WEST FISHER SEED	1988		116			X								
Trail Construction, Maintenance, and Obliteration														
Rock Lake trail # 935	Yearly Mtce.	FS	4 miles		X				X					
Moran Basin Tr #993	Yearly Mtce.	FS	3 miles		X				X					
Engle Pk Tr. # 932	Yrly mtce.	FS	4.5 miles		X				X					
Trail Mtce – Mainline	2006	FS	31.24 miles				X	X						
Trail Mtce-Secondary	2006	FS	2.92 miles				X	X						
Trail Mtce – Way	2006	FS	1.58 miles				X	X						

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
Trail Mtce – Mailine	2005	FS	31.24 miles				X	X						
Trail Mtce-Secondary	2005	FS	8.42 miles				X	X						
Trail Mtce – Way	2005	FS	4.96 miles				X	X						
Trail Mtce - Mainline	2004	FS	31.24 miles				X	X						
Trail Mtce-Secondary	2004	FS	3.75 miles				X	X						
Trail Mtce – Way	2004	FS	20.17 miles				X	X						
Trail Mtce – Mainline	2006	FS	7.07 miles	X					X					
Trail Mtce-Secondary	2006	FS	0.00											
Trail Mtce – Way	2006	FS	18.87 miles	X					X					
Trail Mtce – Mainline	2005	FS	7.07 miles	X					X					
Trail Mtce-Secondary	2005	FS	0.00											
Trail Mtce – Way	2005	FS	0.00											
Trail Mtce – Mainline	2004	FS	7.07 miles	X					X					
Trail Mtce-Secondary	2004	FS	0.00											
Trail Mtce – Way	2004	FS	3.20 miles	X					X					
Trail Mtce – Mainline	2006	FS	10.37 miles			X				X				
Trail Mtce-Secondary	2006	FS	7.57 miles			X				X				
Trail Mtce – Way	2006	FS	59.72 miles			X				X				
Trail Mtce – Mainline	2005	FS	10.37 miles			X				X				
Trail Mtce-Secondary	2005	FS	2.91 miles			X				X				
Trail Mtce – Way	2005	FS	26.06 miles			X				X				
Trail Mtce – Mainline	2004	FS	10.37 miles			X				X				
Trail Mtce-Secondary	2004	FS	0.00											
Trail Mtce – Way	2004	FS	22.85 miles			X				X				
No mention of specific Trail Construction, Maintenance, or Obliteration projects in Silverfish Subunit.														
Tree Planting														
Tree Planting	1915	FS	478 ACRES	X										
	1950s		0	X										
	1960s		38	X										
	1970s		3666	X										
	1980s		1905	X										
	1990s		2107	X										
	2000-2006		24	X										
SILVERFISH	1950s	FS	0			X								
	1960s		112			X								
	1970s		26			X								
	1980s		499			X								
	1990s		343			X								
	2000-2006		0			X								
TREASURE	1915-1948	FS	1622 ACRES				X							
	1950s		0				X							
	1960s		0				X							
	1970s		190				X							
	1980s		812				X							

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, number of permits)	Planning Subunit				BMU			BORZ	LAU		
				C	R	S	T	2	5	6	Cabinet Face	C	R	W
	1990s		1088				X							
	2000-2006		192				X							
Watershed Restoration														
Upper Libby Creek Cleveland Project	2002	FS and private	3,200 feet of stream and riparian area	X					X					
Wildfires														
			Number of fires			X								
Wildfire	1960-1969		9			X								
Wildfire	1970-1979		15			X								
Wildfire	1980-1989		20			X								
Wildfire	1990-1999		18			X								
Wildlife Habitat Improvement														
Miller Creek Wildlife Habitat Improvement Burn	1998	USFS	1, 300 acres			X								
Plum Creek Native Fish Habitat Conservation Plan	2000	Plum Creek	1.6 million acres											

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Appendix F—Supplemental Macroinvertebrate Data

Appendix F: MacroInvertebrate Data, 1988- 2005

NC= Metric Not Calculated Due to Data Limitations
Exact site locations are uncertain from some sources; methods differ between studies and years as well.

Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
East Fork Rock Creek	Aug-85	31	23	74	62	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Oct-85	20	15	75	96	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Oct-85	28	21	75	91	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Apr-86	20	18	90	93	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Aug-86	27	24	89	95	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Aug-86	31	22	71	84	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Oct-86	22	18	82	59	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Apr-87	20	19	95	98	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Aug-87	27	23	85	94	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Oct-87	27	24	89	97	NC	NC	NC	NC	USFS and Montana DEQ, 2001
Bear Creek	Aug-88	38	17	45	77	4.06	0.9158	0.7727	83	Western Resource Development Corp. 1989a
Bear Creek	Aug-88	37	19	51	73	4.12	0.9243	0.7912	84	Western Resource Development Corp. 1989a
Bear Creek	Aug-88	43	29	67	77	4.32	0.9266	0.7969	105	Western Resource Development Corp. 1989a
East Fork Rock Creek	Aug-88	26	23	88	98	NC	NC	NC	NC	USFS and Montana DEQ, 2001
East Fork Rock Creek	Aug-88	26	16	62	87	3.78	0.9050	0.8050	92	Western Resource Development Corp. 1989a
East Fork Rock Creek	Aug-88	38	21	55	56	4.27	0.9153	0.8128	89	Western Resource Development Corp. 1989a
East Fork Rock Creek	Aug-88	42	20	48	46	4.32	0.9242	0.8020	86	Western Resource Development Corp. 1989a
Libby Creek Reach Between Ramsey and Poorman Creeks	Aug-88	46	21	46	40	3.90	0.8920	0.7195	78	Western Resource Development Corp. 1989a
Libby Creek Reach Near Bear Creek confluence	Aug-88	49	28	57	66	3.87	0.8987	0.6900	87	Western Resource Development Corp. 1989a
Libby Creek Reach Near Midas Creek Confluence	Aug-88	43	24	56	68	3.99	0.9091	0.7349	87	Western Resource Development Corp. 1989a
Libby Creek Reach nr Howard Creek confluence	Aug-88	41	21	51	76	4.06	0.9106	0.7580	86	Western Resource Development Corp. 1989a
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-88	49	27	55	57	4.08	0.9180	0.7262	83	Western Resource Development Corp. 1989a
Little Cherry Creek	Aug-88	48	23	48	32	4.02	0.8747	0.7193	85	Western Resource Development Corp. 1989a
Little Cherry Creek	Aug-88	43	27	63	87	4.38	0.9214	0.8076	97	Western Resource Development Corp. 1989a
Poorman Creek	Aug-88	47	23	49	80	4.19	0.8936	0.7538	79	Western Resource Development Corp. 1989a
Poorman Creek	Aug-88	50	27	54	76	4.48	0.9318	0.7932	91	Western Resource Development Corp. 1989a

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Ramsey Creek	Aug-88	40	22	55	67	4.04	0.8944	0.7593	83	Western Resource Development Corp. 1989a
Ramsey Creek	Aug-88	44	22	50	65	4.26	0.9138	0.7802	82	Western Resource Development Corp. 1989a
Ramsey Creek	Aug-88	42	18	43	65	4.30	0.9332	0.7967	92	Western Resource Development Corp. 1989a
Uppermost Libby Creek Reach	Aug-88	37	21	57	78	4.03	0.9132	0.7745	95	Western Resource Development Corp. 1989a
Uppermost Libby Creek Reach	Aug-88	40	21	53	56	4.20	0.9223	0.7893	90	Western Resource Development Corp. 1989a
Bear Creek	Oct-88	40	26	65	91	3.75	0.8836	0.7050	99	Western Resource Development Corp. 1989a
Bear Creek	Oct-88	47	32	68	91	3.95	0.8950	0.7112	114	Western Resource Development Corp. 1989a
Bear Creek	Oct-88	34	23	68	94	3.98	0.9132	0.7821	107	Western Resource Development Corp. 1989a
East Fork Rock Creek	Oct-88	46	20	43	22	1.89	0.4817	0.3415	75	Western Resource Development Corp. 1989a
East Fork Rock Creek	Oct-88	41	24	59	64	4.37	0.8164	0.8164	99	Western Resource Development Corp. 1989a
East Fork Rock Creek	Oct-88	35	24	69	86	4.39	0.9423	0.8567	104	Western Resource Development Corp. 1989a
Libby Creek Reach Between Ramsey and Poorman Creeks	Oct-88	35	25	71	91	3.70	0.8709	0.7222	115	Western Resource Development Corp. 1989a
Libby Creek Reach Near Bear Creek confluence	Oct-88	38	25	66	94	3.54	0.8642	0.6753	106	Western Resource Development Corp. 1989a
Libby Creek Reach Near Midas Creek Confluence	Oct-88	32	23	72	96	3.61	0.8843	0.7214	117	Western Resource Development Corp. 1989a
Libby Creek Reach nr Howard Creek confluence	Oct-88	21	16	76	95	2.96	0.7908	0.6740	126	Western Resource Development Corp. 1989a
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-88	43	25	58	92	3.89	0.8962	0.7171	96	Western Resource Development Corp. 1989a
Little Cherry Creek	Oct-88	40	26	65	66	4.08	0.9106	0.7662	104	Western Resource Development Corp. 1989a
Little Cherry Creek	Oct-88	51	30	59	71	4.46	0.9355	0.7865	83	Western Resource Development Corp. 1989a
Poorman Creek	Oct-88	49	31	63	88	4.02	0.8956	0.7167	96	Western Resource Development Corp. 1989a
Poorman Creek	Oct-88	43	25	58	87	4.08	0.8999	0.7527	95	Western Resource Development Corp. 1989a

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Ramsey Creek	Oct-88	34	24	71	79	3.73	0.8650	0 7327	106	Western Resource Development Corp. 1989a
Ramsey Creek	Oct-88	30	21	70	95	3.78	0.9035	0.7700	111	Western Resource Development Corp. 1989a
Ramsey Creek	Oct-88	33	17	52	74	3.83	0.8698	0.7588	102	Western Resource Development Corp. 1989a
Uppermost Libby Creek Reach	Oct-88	33	17	52	79	3.37	0.8316	0.6682	84	Western Resource Development Corp. 1989a
Uppermost Libby Creek Reach	Oct-88	38	27	71	95	3.69	0.8713	0.7031	116	Western Resource Development Corp. 1989a
Bear Creek	Apr-89	49	27	55	90	4.01	0.9064	0.7139	88	Western Resource Development Corp. 1989a
Bear Creek	Apr-89	40	21	53	64	4.09	0.9155	0.7684	83	Western Resource Development Corp. 1989a
Bear Creek	Apr-89	36	18	50	64	4.28	0.9272	0.8277	86	Western Resource Development Corp. 1989a
East Fork Rock Creek	Apr-89	37	23	62	91	3.07	0.7637	0.5885	89	Western Resource Development Corp. 1989a
East Fork Rock Creek	Apr-89	50	18	36	39	3.68	0.8862	0.6526	66	Western Resource Development Corp. 1989a
East Fork Rock Creek	Apr-89	NS	NS	NS	NS	NS	NS	NS	NS	Western Resource Development Corp. 1989a
Libby Creek Reach Between Ramsey and Poorman Creeks	Apr-89	42	24	57	62	4.18	0.9205	0.7757	87	Western Resource Development Corp. 1989a
Libby Creek Reach Near Bear Creek confluence	Apr-89	47	30	64	86	4.10	0.9005	0.7390	99	Western Resource Development Corp. 1989a
Libby Creek Reach Near Midas Creek Confluence	Apr-89	37	20	54	70	3.98	0.8962	0.7635	86	Western Resource Development Corp. 1989a
Libby Creek Reach nr Howard Creek confluence	Apr-89	33	17	52	77	3.69	0.8760	0.7317	82	Western Resource Development Corp. 1989a
Libby Creek Reach Upstream of Crazyman Creek Confluence	Apr-89	51	27	53	81	4.08	0.8761	0.7198	83	Western Resource Development Corp. 1989a
Little Cherry Creek	Apr-89	36	20	56	35	3.98	0.9025	0.7708	83	Western Resource Development Corp. 1989a
Little Cherry Creek	Apr-89	50	24	48	33	4.03	0.8648	0.7133	77	Western Resource Development Corp. 1989a
Poorman Creek	Apr-89	43	24	56	41	4.35	0.9325	0.8022	81	Western Resource Development Corp. 1989a
Poorman Creek	Apr-89	51	27	53	71	4.37	0.9232	0.7711	85	Western Resource Development Corp. 1989a

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Ramsey Creek	Apr-89	46	24	52	64	4.00	0.8990	0.7250	100	Western Resource Development Corp. 1989a
Ramsey Creek	Apr-89	55	28	51	53	4.04	0.9018	0.6981	80	Western Resource Development Corp. 1989a
Ramsey Creek	Apr-89	46	27	59	52	4.26	0.9267	0.7710	93	Western Resource Development Corp. 1989a
Uppermost Libby Creek Reach	Apr-89	39	22	56	63	4.03	0.9086	0.7625	90	Western Resource Development Corp. 1989a
Uppermost Libby Creek Reach	Apr-89	38	19	50	65	4.15	0.9161	0.7917	79	Western Resource Development Corp. 1989a
Libby Creek Reach Immediately Upstream of Falls	Apr-90	22	14	64	92	3.23	0.8493	0.7256	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Crazyman Creek Confluence	Apr-90	24	19	79	61	3.61	0.8771	0.7678	NC	Western Technology and Engineering, Inc. 1991
Little Cherry Creek	Apr-90	26	18	69	87	3.17	0.8107	0.6748	NC	Western Technology and Engineering, Inc. 1991
Poorman Creek	Apr-90	24	19	79	87	2.81	0.7358	0.6128	NC	Western Technology and Engineering, Inc. 1991
Ramsey Creek	Apr-90	22	19	86	94	2.97	0.7880	0.6567	NC	Western Technology and Engineering, Inc. 1991
Uppermost Libby Creek Reach	Apr-90	16	14	88	96	2.99	0.8289	0.7465	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Immediately Upstream of Falls	Aug-90	26	18	69	89	3.60	0.8918	0.7654	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-90	33	24	73	96	3.37	0.8549	0.6684	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Little Cherry Creek	Aug-90	27	22	81	95	3.37	0.8641	0.7100	NC	Western Technology and Engineering, Inc. 1991
Poorman Creek	Aug-90	24	21	88	95	3.27	0.8636	0.7136	NC	Western Technology and Engineering, Inc. 1991
Ramsey Creek	Aug-90	30	25	83	88	3.85	0.8893	0.7765	NC	Western Technology and Engineering, Inc. 1991
Uppermost Libby Creek Reach	Aug-90	23	19	83	93	3.26	0.8382	0.7200	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Immediately Upstream of Falls	Oct-90	35	28	80	90	3.28	0.8132	0.6401	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-90	34	27	79	98	2.84	0.7311	0.5589	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Little Cherry Creek	Oct-90	34	27	79	98	2.94	0.7873	0.5774	NC	Western Technology and Engineering, Inc. 1991

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Little Cherry Creek	Oct-90	35	28	80	92	3.71	0.8723	0.7227	NC	Western Technology and Engineering, Inc. 1991
Poorman Creek	Oct-90	24	22	92	99	2.58	0.6822	0.5561	NC	Western Technology and Engineering, Inc. 1991
Ramsey Creek	Oct-90	24	19	79	98	2.87	0.7996	0.6265	NC	Western Technology and Engineering, Inc. 1991
Uppermost Libby Creek Reach	Oct-90	27	23	85	95	3.00	0.7733	0.6313	NC	Western Technology and Engineering, Inc. 1991
Bear Creek	May-91	31	26	84	98	3.12	0.8297	0.6301	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Immediately Upstream of Falls	May-91	19	17	89	94	3.19	0.8559	0.7506	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Crazyman Creek Confluence	May-91	34	27	79	95	3.33	0.8366	0.6545	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Little Cherry Creek	May-91	25	19	76	92	3.13	0.8335	0.6740	NC	Western Technology and Engineering, Inc. 1992
Little Cherry Creek	May-91	24	20	83	95	3.37	0.8493	0.7356	NC	Western Technology and Engineering, Inc. 1992
Poorman Creek	May-91	25	22	88	94	3.56	0.8752	0.7668	NC	Western Technology and Engineering, Inc. 1992
Ramsey Creek	May-91	28	23	82	91	3.33	0.8528	0.6922	NC	Western Technology and Engineering, Inc. 1992
Uppermost Libby Creek Reach	May-91	29	22	76	87	3.28	0.8391	0.6745	NC	Western Technology and Engineering, Inc. 1992
Bear Creek	Aug-91	35	28	80	98	2.86	0.7981	0.5570	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Immediately Upstream of Falls	Aug-91	34	27	79	93	3.10	0.8150	0.6085	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-91	35	28	80	93	3.17	0.8158	0.6182	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Little Cherry Creek	Aug-91	33	26	79	93	3.03	0.7947	0.6007	NC	Western Technology and Engineering, Inc. 1992
Little Cherry Creek	Aug-91	24	19	79	91	3.37	0.8593	0.7353	NC	Western Technology and Engineering, Inc. 1992
Poorman Creek	Aug-91	31	24	77	97	2.93	0.8185	0.5913	NC	Western Technology and Engineering, Inc. 1992
Ramsey Creek	Aug-91	33	26	79	96	3.34	0.8607	0.6614	NC	Western Technology and Engineering, Inc. 1992
Uppermost Libby Creek Reach	Aug-91	30	22	73	80	3.45	0.8709	0.7021	NC	Western Technology and Engineering, Inc. 1992

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Bear Creek	Oct-91	37	30	81	99	3.24	0.8218	0.6227	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Immediately Upstream of Falls	Oct-91	32	27	84	99	2.17	0.5712	0.4332	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-91	37	31	84	99	2.90	0.7939	0.5567	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Little Cherry Creek	Oct-91	36	31	86	99	3.22	0.8396	0.6234	NC	Western Technology and Engineering, Inc. 1992
Little Cherry Creek	Oct-91	38	32	84	87	3.85	0.8680	0.7329	NC	Western Technology and Engineering, Inc. 1992
Poorman Creek	Oct-91	36	31	86	99	2.92	0.7535	0.5652	NC	Western Technology and Engineering, Inc. 1992
Ramsey Creek	Oct-91	34	29	85	98	3.39	0.8477	0.6656	NC	Western Technology and Engineering, Inc. 1992
Uppermost Libby Creek Reach	Oct-91	39	30	77	97	3.68	0.8913	0.6962	NC	Western Technology and Engineering, Inc. 1992
Bear Creek	Apr-92	38	29	76	84	3.63	0.8724	0.6908	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Immediately Upstream of Falls	Apr-92	35	28	80	73	3.39	0.8370	0.6616	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Crazyman Creek Confluence	Apr-92	29	18	62	84	3.58	0.8866	0.7360	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Little Cherry Creek	Apr-92	39	30	77	86	3.78	0.8895	0.7158	NC	Western Technology and Engineering, Inc. 1993
Little Cherry Creek	Apr-92	35	27	77	74	3.88	0.8990	0.7572	NC	Western Technology and Engineering, Inc. 1993
Poorman Creek	Apr-92	24	20	83	93	3.52	0.8836	0.7670	NC	Western Technology and Engineering, Inc. 1993
Ramsey Creek	Apr-92	36	29	81	72	3.39	0.8439	0.6564	NC	Western Technology and Engineering, Inc. 1993
Uppermost Libby Creek Reach	Apr-92	33	28	85	88	3.26	0.7890	0.6455	NC	Western Technology and Engineering, Inc. 1993
Bear Creek	Aug-92	39	32	82	91	3.73	0.8792	0.7055	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Immediately Upstream of Falls	Aug-92	29	22	76	90	3.48	0.8596	0.7170	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-92	35	27	77	79	3.21	0.8093	0.6254	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Little Cherry Creek	Aug-92	32	26	81	91	3.69	0.8953	0.7378	NC	Western Technology and Engineering, Inc. 1993

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Little Cherry Creek	Aug-92	35	29	83	88	3.38	0.8438	0.6590	NC	Western Technology and Engineering, Inc. 1993
Poorman Creek	Aug-92	24	21	88	95	3.34	0.8664	0.7278	NC	Western Technology and Engineering, Inc. 1993
Ramsey Creek	Aug-92	35	28	80	94	3.87	0.9134	0.7538	NC	Western Technology and Engineering, Inc. 1993
Uppermost Libby Creek Reach	Aug-92	24	18	75	81	3.66	0.9042	0.7978	NC	Western Technology and Engineering, Inc. 1993
Bear Creek	Oct-92	43	35	81	90	3.62	0.8718	0.6650	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Immediately Upstream of Falls	Oct-92	34	29	85	96	3.01	0.7923	0 5919	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-92	38	27	71	91	3.57	0.8650	0.6802	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Little Cherry Creek	Oct-92	70	30	43	89	3.98	0.9164	0.7482	NC	Western Technology and Engineering, Inc. 1993
Little Cherry Creek	Oct-92	41	34	83	88	3.81	0.8615	0.7118	NC	Western Technology and Engineering, Inc. 1993
Poorman Creek	Oct-92	42	33	79	88	3 42	0.8499	0.6337	NC	Western Technology and Engineering, Inc. 1993
Ramsey Creek	Oct-92	40	31	78	84	3 61	0.8744	0.6787	NC	Western Technology and Engineering, Inc. 1993
Uppermost Libby Creek Reach	Oct-92	34	27	79	89	3.73	0.8906	0.7334	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Immediately Upstream of Falls	Mar-93	36	29	81	79	3.62	0.8751	0.7006	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Crazyman Creek Confluence	Mar-93	28	21	75	89	3.10	0.7904	0.6439	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Little Cherry Creek	Mar-93	31	28	90	74	3.09	0.8155	0.6240	NC	Western Technology and Engineering, Inc. 1994
Uppermost Libby Creek Reach	Mar-93	33	27	82	52	3.05	0.7539	0.6040	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Immediately Upstream of Falls	Aug-93	37	26	70	78	3.83	0.9047	0.7353	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-93	43	31	72	64	3.44	0.8427	0.6341	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Little Cherry Creek	Aug-93	43	30	70	78	3.24	0.8473	0 5966	NC	Western Technology and Engineering, Inc. 1994
Uppermost Libby Creek Reach	Aug-93	40	29	73	78	3.83	0.8984	0.7202	NC	Western Technology and Engineering, Inc. 1994

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Libby Creek Reach Immediately Upstream of Falls	Oct-93	41	31	76	94	3.47	0.8407	0.6474	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-93	53	40	75	90	3.93	0.8909	0.6869	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Little Cherry Creek	Oct-93	53	38	72	79	4.03	0.9119	0.7010	NC	Western Technology and Engineering, Inc. 1994
Uppermost Libby Creek Reach	Oct-93	33	27	82	86	3.59	0.8765	0.7115	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Immediately Upstream of Falls	Oct-94	52	43	83	75	3.73	0.8783	0.6555	NC	Western Technology and Engineering, Inc. and Phycologic, 1995
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-94	48	34	71	95	3.21	0.7755	0.5755	NC	Western Technology and Engineering, Inc. and Phycologic, 1995
Uppermost Libby Creek Reach	Oct-94	49	38	78	63	3.46	0.8281	0.6163	NC	Western Technology and Engineering, Inc. and Phycologic, 1995
Bear Creek	Sep-98	32	23	72	86	2.73	0.1033	0.6200	97	USFS 2006
Libby Creek Reach Immediately Upstream of Falls	Sep-98	24	17	71	77	2.29	0.1580	0.6240	91	USFS 2006
Libby Creek Reach Upstream of Crazyman Creek Confluence	Sep-98	32	25	78	63	2.42	0.1543	0.5490	84	USFS 2006
West Fisher Creek	Sep-98	28	19	68	72	2.38	0.1377	0.6450	119	USFS 2006
Bear Creek	Aug-99	31	21	68	74	2.63	0.1013	0.7097	87	USFS 2006
Libby Creek Reach Immediately Upstream of Falls	Aug-99	28	20	71	74	2.46	0.1407	0.5887	98	USFS 2006
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-99	32	22	69	85	2.22	0.2210	0.4390	89	USFS 2006
West Fisher Creek	Aug-99	33	23	70	66	2.61	0.1207	0.5917	120	USFS 2006
Bear Creek	Aug-00	32	24	75	68	2.75	0.0983	0.6500	90	USFS 2006
Libby Creek Reach Immediately Upstream of Falls	Sep-00	24	16	67	60	2.26	0.1833	0.5633	92	USFS 2006
Libby Creek Reach Near Midas Creek Confluence	Sep-00	33	25	76	95	NC	NC	NC	NC	Dunnigan et al., 2004, Hoffman et al., 2002
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-00	29	22	76	89	2.25	0.1807	0.5537	96	USFS 2006
West Fisher Creek	Oct-00	28	17	61	46	2.26	0.1800	0.5547	111	USFS 2006
Bear Creek	Aug-01	33	23	70	64	2.66	0.1170	0.5710	85	USFS 2006
Fisher River at Highway 2	Aug-01	34	19	56	28	2.62	0.1180	0.5910	84	USFS 2006
Libby Creek Reach Immediately Upstream of Falls	Aug-01	39	28	72	56	2.55	0.1480	0.4860	89	USFS 2006
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-01	43	28	65	61	2.59	0.1310	0.5370	86	USFS 2006
West Fisher Creek	Aug-01	39	26	67	63	2.83	0.0960	0.5960	122	USFS 2006

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Fisher River at Highway 2	Jul-02	10	7	70	67	2.02	0.1300	-	80	USFS 2006
West Fisher Creek	Jul-02	29	19	66	40	2.64	0.1100	0.6210	100	USFS 2006
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-02	13	11	85	86	2.25	0.1180	0.8820	111	USFS 2006
Fisher River at Highway 2	Aug-03	16	9	56	33	2.10	0.1910	0.5920	91	USFS 2006
Libby Creek Reach Near Midas Creek Confluence	Aug-03	35	28	80	81	NC	NC	NC	NC	Dunnigan et al., 2004
West Fisher Creek	Aug-03	39	23	59	55	2.79	0.0910	0.6540	105	USFS 2006
Bear Creek	Aug-03	39	29	74	60	3.01	0.0680	0.7150	85	USFS 2006
Libby Creek Reach Immediately Upstream of Falls	Aug-03	41	28	68	51	2.47	0.1470	0.5340	82	USFS 2006
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-03	34	24	71	73	3.09	0.0580	0.7850	88	USFS 2006
Fisher River at Highway 2	Jul-04	37	25	68	14	1.92	0.2760	0.4530	91	USFS 2006
West Fisher Creek	Jul-04	27	20	74	84	2.51	0.1300	0.5970	125	USFS 2006
Bear Creek	Jul-04	28	22	79	84	2.54	0.1170	0.6440	100	USFS 2006
Libby Creek Reach Immediately Upstream of Falls	Jul-04	30	24	80	95	2.47	0.1350	0.5910	132	USFS 2006
Libby Creek Reach Near Bear Creek confluence	Jul-04	21	18	86	92	2.63	0.0910	0.7720	122	USFS 2006
Libby Creek Reach Upstream of Crazyman Creek Confluence	Jul-04	42	27	64	26	1.75	0.4310	0.2790	83	USFS 2006
East Fork Rock Creek	Sep-05	9	4	44	80	1.53	0.5075	0.4819	NC	Geomatrix 2006a
East Fork Rock Creek	Sep-05	7	2	29	24	1.08	0.5894	0.3831	NC	Geomatrix 2006a
East Fork Rock Creek	Sep-05	11	4	36	3	0.69	0.8313	0.1986	NC	Geomatrix 2006a

Appendix G—Water Quality Mass Balance Calculations

LAD Area Ground Water Flux

ALTERNATIVE 2

Existing Conditions (natural gradient)

	K (ft/day)	i (gradient, unitless)	depth of mixing zone (ft)	width of mixing zone (ft)	cross sectional area (A) (ft^2)
MMC values	1	0 06	56	6860	451388
modified K	0 22				
Ramsey Creek - LAD #1				3040	200032
Ramsey Creek - LAD #2				840	55272
Libby Creek - LAD #2				1040	68432
Poorman Creek - LAD #2				1940	127652
				6860	

Pre-LAD GW Flux:

Q=KiA

K = 1 ft/day	27083 28 cubic feet per day		
	0.31 cfs		140 68 gpm
	5958 3216 cubic feet per day		
K = 0 22 ft/day	0 07 cfs		30 95 gpm

	cubic ft/day	cfs	gpm
Ramsey Creek - LAD #1	2640 4224	0 03	13 72
Ramsey Creek - LAD #2	729 5904	0 01	3 79
Libby Creek - LAD #2	903 3024	0 01	4 69
Poorman Creek - LAD #2	1685 0064	0 02	8 75
			30 95

Maximum total flux (pre-LAD plus LAD application):

Maximum gradient to have ground water mounding to within ~10 bgs at LAD Areas is 0 122 (measured from topo map)

K = 1 ft/day: 55069 336 cubic feet per day; 0 64 cfs; 286 05 gpm

K = 0 22 ft/day: 12115 25392 cubic feet per day; 0 14 cfs; 62 93 gpm

LAD#1	cubic ft/day	cfs	gpm
Ramsey Creek - LAD #1	5368 85888	0 06	27 89
LAD#2			
Ramsey Creek - LAD #2	1483 50048	0 02	7 71
Libby Creek - LAD #2	1836 71488	0 02	9 54
Poorman Creek - LAD #2	3426 17968	0 04	17 80
			62 93

Allowable percolation to ground water without flooding ground surface is:

K = 1 ft/day: 145 37 gpm

K = 0 22 ft/day: 31 98 gpm

	GPM
Ramsey Creek - LAD #1	14 17
Ramsey Creek - LAD #2	3 92
Libby Creek - LAD #2	4 85
Poorman Creek - LAD #2	9 04
	31 98

NOTES Width is width of LAD area (normal to gw flow direction) + tan 5 degrees x the width added to both sides
Depth is based on avg depth to bedrock of 76' and avg depth to water of 20 '

ALTERNATIVES 3 AND 4

Existing Conditions (natural gradient)

	K (ft/day)	i (gradient, unitless)	depth of mixing zone (ft)	width of mixing zone (ft)	cross sectional area (A) (ft^2)
	1	0 06	56	10150	667870
LAD #1	0 22				
Ramsey Creek				3960	260568
Poorman Creek				720	47376
LAD#2					
Ramsey Creek				2370	155946
Poorman Creek				2300	151340
Libby Creek				800	52640
				10150	

Pre-LAD GW Flux:

Q=Kia

	40072 2 cubic feet per day	
K = 1 ft/day	0.46 cfs	208 15 gpm
	8815 884 cubic feet per day	
K = 0 22 ft/day	0 10 cfs	45 79 gpm

LAD #1	cubic ft/day	CFS	gpm
Ramsey Creek	3439 4976	0 04	17 87
Poorman Creek	625 3632	0 01	3 25
LAD#2			
Ramsey Creek	2058 4872	0 02	10 69
Poorman Creek	1997 688	0 02	10 38
Libby Creek	694 848	0 01	3 61
			45 79

Max total flux (pre-LAD plus LAD application):

Maximum gradient to have ground water mounding to within ~10 bgs at LAD Areas is 0 122

K = 1 ft/day: 81480 14 cubic feet per day; 0 94 cfs; 423 24 gpm

K = 0 22 ft/day: 17925 6308 cubic feet per day; 0 21 cfs; 93 11 gpm

LAD#1	cubic ft/day	cfs	gpm
Ramsey Creek	6993 64512	0 08	36 33
Poorman Creek	1271 57184	0 01	6 61
			42 93
LAD#2			
Ramsey Creek	4185 59064	0 05	21 74
Poorman Creek	4061 9656	0 05	21 10
Libby Creek	1412 8576	0.02	7 34
			50 18
			93 11

Allowable percolation to ground water without flooding ground surface is:

K = 1 ft/day: 215 09 gpm

K = 0 22 ft/day: 47 32 gpm

LAD#1	GPM	
Ramsey Creek	18 46	
Poorman Creek	3 36	
	21 82	
LAD#2		
Ramsey Creek	11 05	
Poorman Creek	10 72	
Libby Creek	3 73	
	25 50	47 32

LAD Application Rates

Maximum application rate for	200 acre LAD area		
ET during 6-mo growing season =	18 in/growing season, or	0.0082 ft/day	
Precip during growing season =	13.24 in/growing season, or	0.0060 ft/day	
Precip per year =	36 in/year	0.0060 ft/day	
ET on 200 acres=	370.96 gpm		
Precip on 200 acres=	272.86 gpm		
		K= 1 ft/day	K = 0.22 ft/day
Alternative 2 maximum ground water flux rate=		145.37 gpm	31.98 gpm
Alts 3 and 4 maximum ground water flux rate=		215.09 gpm	47.32 gpm
		K = 1 ft/day	K = 0.22 ft/day
Maximum LAD application rate= (for 200 acres)	ET+ground water flux rate-precip=	**243.47 gpm for Alternative 2**	**130.08 gpm for Alternative 2**
		313.19 gpm for Alts 3 and 4	**145.42 gpm for Alts 3 and 4**

Alternative 2	**Area (ac)**	**Percolation to ground water**	**Proportion of total perc to ground water**	**ET-PPT**	**Max Application Rate**	**LAD Total Max Application Rate**	
LAD#1		**gpm**		**gpm**	**gpm**	**gpm**	
Ramsey Creek	100	14.17	100%	49.05	63.22	63.22	LAD # 1
LAD#2							
Ramsey Creek	20	3.92	20%	9.81	13.73	66.86	LAD # 2
Libby Creek	30	4.85	30%	14.71	19.56		
Poorman Creek	50	9.04	50%	24.52	33.57		
	200					**130.08**	**total**

Alternatives 3 & 4	**Area (ac)**	**Percolation to ground water**	**Proportion of total perc to ground water**	**ET-PPT**	**Max Application Rate**	**LAD Total Max Application Rate**	
LAD#1		**gpm**		**gpm**	**gpm**	**gpm**	
Ramsey Creek	162.5	18.46	90%	79.70	98.17	114.72	LAD #1
Poorman Creek	26.9	3.36	10%	13.19	16.55		
LAD#2							
Ramsey Creek	40.3	11.05	53%	19.77	30.82	83.13	LAD#2
Poorman Creek	62	10.72	34%	30.41	41.13		
Libby Creek	15.2	3.73	13%	7.46	11.19		
	306.9					**197.85**	**total**

NOTES: Actual ET=12.71 inches is for average precipitation conditions, mountainous coniferous forest in NW Montana
Potential ET=26 inches, which is for unrestricted water availability (used by Geomatrix)
Actual ET=PET-actual soil moisture content

Calculation of 7Q10 low flows for Montanore site

7Q10 (cfs) = 0.0000728*A^(1.06)*P^(1. Reference: Hortness, 2006.

A=drainage area in square miles
P=precipitation in inches

Monitoring site	Drainage Area (sq miles)	Precipitation (inches)	Average 7Q10 (cfs)	Low range 7Q10 (cfs)	High range 7Q10 (cfs)
LB 300	7.4	63	2.22	1.04	4.73
LB 800	23.9	49.9	4.85	2.27	10.32
LB 1000	34.1	48	6.54	3.07	13.93
LB 1500	37	48	7.13	3.35	15.19
LB 2000	40.7	46	7.25	3.40	15.45
PM 1000	5.8	47.3	0.97	0.46	2.07
PM 1200	6.2	46	0.99	0.46	2.10
RA 400	5.9	56	1.38	0.65	2.94
RA 600	6.8	53.3	1.46	0.68	3.10

	Gpm
LB 300	996
LB 800	2,175
LB 1000	2,936
LB 1500	3,201
LB 2000	3,255
PM 1000	436
PM 1200	443
RA 400	620
RA 600	654

MINE DISCHARGE RATES

Rates limited by ground water horizontal K, so flow rates are same for construction, mining and post-mining at LAD areas
For natural ground water flow, use 35 gpm for under tailings impoundment, 31 gpm for LAD areas in Alt 2, 46 gpm for LAD areas Alts 3&4.

	Construction			Mining			Post-mining		
	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4
Outflows									
@ LADs									
ET @ LADs									
Seepage to GW									
To Ramsey Creek									
RA 400	14	18.5	18.5	14	18.5	18.5	14	18.5	18.5
RA 600	4	11	11	4	11	11	4	11	11
To Poorman Creek									
PM 1000		3.4	3.4		3.4	3.4		3.4	3.4
PM 1200	9	10.7	10.7	9	10.7	10.7	9	10.7	10.7
To Libby Creek LB 800	5	3.7	3.7	5	3.7	3.7	5	3.7	3.7
Subtotal									
Percent Sources--LAD Areas									
Construction	all construction adit water								
Mining	25% mine water, 75% mining adit water								
Post-Mining	all post mining TI water								
Discharge from Treatment Plants									
Water to Libby Adit Treatment Plant (LB 300)	345	201	201	164	350	130	35	291	0
Water to Ramsey Treatment Plant (LB 800)	130	0	0	0	0	0	0	0	0

	Alt 2	Alt 3	Alt 4
Construction Inflows			
From Libby Adit(s)	345#	300+	300+
From Ramsey Adits	195#		
Total Inflows	540*	300	300
Construction Discharge Management			
To LADs (average annual rate)	65	99	99
To Libby WTP	345	201	201
To Ramsey WTP	130	0	0
Total Discharge	540	300	300

Assumption and Sources:
*Table 3 1/07 MPDES Permit Application
#Table 3 1/07 MPDES Permit Application; 1/2 Ramsey Adits to Libby Adit, other 1/2 out Ramsey Adits
+Twice steady state modeled inflow of Libby Adit

	Alt 2	Alt 3	Alt 4
Mining Discharges Total Average Annual Excess Water	229	449	229
Average annual discharge to LADs	65	99	99
To Libby WTP	164	350	130

	Alt 2	Alt 3	Alt 4
Post-Mining Discharges Total Average Annual Excess Water	100	390	100
Average annual discharge to LADs	65	99	99
To Libby WTP	35	291	1

TREATMENT WATER QUALITY CALCULATIONS

Alternative 2

LAD applicaton area=	200	acres
LAD application rate=	130	gpm
Precipitation on 200 acres=	273	gpm
ET on 200 acres=	371	gpm
Net applied water=	32	gpm

		Mine Wastewater		Adit Wastewater During Construction		Adit Wastewater Post-Construction	
	Treatment Rate	Mine wastewater concentration (mg/L)	Concentration of percolate to ground water	Construction adit wastewater concentration (mg/L)	Concentration of percolate to ground water	Post-construction adit water concentration (mg/L)	Concentration of percolate to ground water
TDS	0%	140	569	162	658	162	658
Ammonia	50%	10	20.31	10	20.31	<0.06	<0.12
Nitrate	50%	25	50.78	25	50.78	<0.21	<0.43
Antimony	50%	0.009	0.018	<0.003	<0.006	<0.003	<0.006
Arsenic	50%	<0.002	<0.004	<0.004	<0.008	<0.004	<0.008
Cadmium	50%	<0.0002	<0.0004	<0.0003	<0.0006	<0.0003	<0.0006
Chromium	50%	<0.001	<0.002	<0.006	<0.012	<0.006	<0.012
Copper	90%	0.045	0.018	<0.004	<0.002	<0.004	<0.002
Iron	50%	0.03	0.06	<0.05	<0.10	<0.05	<0.10
Lead	90%	<0.002	<0.001	<0.004	<0.002	<0.004	<0.002
Manganese	10%	0.044	0.161	<0.01	<0.04	<0.01	<0.04
Mercury	50%	<0.0002	<0.0004	<0.0002	<0.0004	<0.0002	<0.0004
Silver	50%	<0.003	<0.006	<0.0007	<0.0014	<0.0007	<0.0014
Zinc	10%	0.01	0.04	<0.03	<0.11	<0.03	<0.11

Alternatives 3 and 4

LAD applicaton area=	307	acres
LAD application rate=	198	gpm
Precipitation on 307 acres=	419	gpm
ET on 307 acres=	569	gpm
Net applied water=	48	gpm

	Treatment Rate	Mine wastewater concentration after 90% nitrate removal (mg/L)	Concentration of percolate to ground water	Construction adit wastewater concentration after 90% nitrate removal	Concentration of percolate to ground water	Post-construction adit water concentration (mg/L)	Concentration of percolate to ground water
TDS	0%	140	583	162	674	162	674
Ammonia	50%	10	20.81	10	20.81	<0.06	<0.12
Nitrate	50%	2.5	5.2	2.5	5.2	<0.21	<0.44
Antimony	50%	0.009	0.019	<0.003	<0.006	<0.003	<0.006
Arsenic	50%	<0.002	<0.004	<0.004	<0.008	<0.004	<0.008
Cadmium	50%	<0.0002	<0.0004	<0.0003	<0.0006	<0.0003	<0.0006
Chromium	50%	<0.001	<0.002	<0.006	<0.012	<0.006	<0.012
Copper	90%	0.045	0.019	<0.004	<0.002	<0.004	<0.002
Iron	50%	0.03	0.06	<0.05	<0.10	<0.05	<0.10
Lead	90%	<0.002	<0.001	<0.004	<0.002	<0.004	<0.002
Manganese	10%	0.044	0.165	<0.01	<0.04	<0.01	<0.04
Mercury	50%	<0.0002	<0.0004	<0.0002	<0.0004	<0.0002	<0.0004
Silver	50%	<0.003	<0.006	<0.0007	<0.0010	<0.0007	<0.0015
Zinc	10%	0.01	0.04	<0.03	<0.11	<0.03	<0.11

Tailings Wastewater Post-Operations

Tailings impoundment post-mining water	Concentration of percolate to ground water
200	813
7.3	14.8
16.1	32.7
0.009	0.018
<0.005	<0.010
<0.002	<0.004
<0.001	<0.002
0.035	0.014
<0.04	<0.08
<0.013	<0.005
0.54	1.97
<0.001	<0.002
<0.004	<0.008
<0.02	<0.07

Tailings impoundment post-mining water after 90% nitrate removal	Concentration of percolate to ground water
200	832
7.3	15.2
1.6	3.4
0.009	0.019
<0.005	<0.010
<0.002	<0.004
<0.001	<0.002
0.035	0.015
<0.04	<0.08
<0.013	<0.005
0.54	2.02
<0.001	<0.002
<0.004	<0.008
<0.02	<0.07

RAMSEY CREEK at RA 400

Construction

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	620	658	14	658	0	569	0	100	0	813	0	<27	634		100
Ammonia	<0.05	620	20.31	14	<0.12	0	20.31	0	0.05	0	14.8	0	<0.50	634	True	TIN=1
Nitrate	<0.06	620	50.78	14	<0.43	0	50.78	0	0.03	0	32.7	0	<1.18	634	True	TIN=1
Antimony	<0.003	620	<0.006	14	<0.006	0	0.018	0	0.003	0	<0.018	0	<0.003	634		0.0056
Copper	<0.001	620	<0.002	14	<0.002	0	<0.018	0	0.002	0	0.014	0	<0.001	634		0.003
Iron	<0.05	620	<0.10	14	<0.10	0	0.06	0	0.01	0	<0.08	0	<0.05	634		0.1
Manganese	<0.02	620	<0.04	14	<0.04	0	0.161	0	0.005	0	1.97	0	<0.02	634		0.05
Zinc	<0.02	620	<0.11	14	<0.11	0	<0.04	0	0.01	0	<0.07	0	<0.02	634		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	620	674	18.5	674	0	583	0	100	0	832	0	<32	638.5		100
Ammonia	<0.05	620	20.81	18.5	<0.12	0	20.81	0	0.05	0	15.2	0	<0.65	638.5		TIN=1
Nitrate	<0.06	620	5.2	18.5	<0.44	0	5.2	0	0.03	0	3.4	0	<0.21	638.5		TIN=1
Antimony	<0.003	620	<0.006	18.5	<0.006	0	0.019	0	0.003	0	<0.019	0	<0.003	638.5		0.0056
Copper	<0.001	620	<0.002	18.5	<0.002	0	<0.019	0	0.002	0	0.015	0	<0.001	638.5		0.003
Iron	<0.05	620	<0.10	18.5	<0.10	0	0.06	0	0.01	0	<0.08	0	<0.05	638.5		0.1
Manganese	<0.02	620	<0.04	18.5	<0.04	0	0.165	0	0.005	0	2.02	0	<0.02	638.5		0.05
Zinc	<0.02	620	<0.11	18.5	<0.11	0	<0.04	0	0.01	0	<0.07	0	<0.02	638.5		0.025

RAMSEY CREEK at RA 400
Mining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	620	658	0	658	9.25	569	4.75	100	0	813	0	<27	634		100
Ammonia	<0.05	620	20.31	0	<0.12	9.25	20.31	4.75	0.05	0	14.8	0	<0.20	634		TIN=1
Nitrate	<0.06	620	50.78	0	<0.43	9.25	50.78	4.75	0.03	0	32.7	0	<0.45	634		TIN=1
Antimony	<0.003	620	<0.006	0	<0.006	9.25	0.018	4.75	0.003	0	<0.018	0	<0.003	634		0.0056
Copper	<0.001	620	<0.002	0	<0.002	9.25	<0.018	4.75	0.002	0	0.014	0	<0.001	634		0.003
Iron	<0.05	620	<0.10	0	<0.10	9.25	0.06	4.75	0.01	0	<0.08	0	<0.05	634		0.1
Manganese	<0.02	620	<0.04	0	<0.04	9.25	0.161	4.75	0.005	0	1.97	0	<0.02	634		0.05
Zinc	<0.02	620	<0.11	0	<0.11	9.25	<0.04	4.75	0.01	0	<0.07	0	<0.02	634		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	620	674	0	674	12.25	583	6.25	100	0	832	0	<31	638.5		100
Ammonia	<0.05	620	20.81	0	<0.12	12.25	20.81	6.25	0.05	0	15.2	0	<0.25	638.5		TIN=1
Nitrate	<0.06	620	5.2	0	<0.44	12.25	5.2	6.25	0.03	0	3.4	0	<0.12	638.5		TIN=1
Antimony	<0.003	620	<0.006	0	<0.006	12.25	0.019	6.25	0.003	0	<0.019	0	<0.003	638.5		0.0056
Copper	<0.001	620	<0.002	0	<0.002	12.25	<0.019	6.25	0.002	0	0.015	0	<0.001	638.5		0.003
Iron	<0.05	620	<0.10	0	<0.10	12.25	0.06	6.25	0.01	0	<0.08	0	<0.05	638.5		0.1
Manganese	<0.02	620	<0.04	0	<0.04	12.25	0.165	6.25	0.005	0	2.02	0	<0.02	638.5		0.05
Zinc	<0.02	620	<0.11	0	<0.11	12.25	<0.04	6.25	0.01	0	<0.07	0	<0.02	638.5		0.025

RAMSEY CREEK at RA 400

Postmining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	620	658	0	658	0	569	0	100	0	813	14	<31	634.0		100
Ammonia	<0.05	620	20.31	0	<0.12	0	20.31	0	0.05	0	14.8	14	<0.38	634.0	True	TIN=1
Nitrate	<0.06	620	50.78	0	<0.43	0	50.78	0	0.03	0	32.7	14	<0.78	634.0	True	TIN=1
Antimony	<0.003	620	<0.006	0	<0.006	0	0.018	0	0.003	0	<0.018	14	<0.003	634.0		0.0056
Copper	<0.001	620	<0.002	0	<0.002	0	<0.018	0	0.002	0	0.014	14	<0.001	634.0		0.003
Iron	<0.05	620	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	14	<0.05	634.0		0.1
Manganese	<0.02	620	<0.04	0	<0.04	0	0.161	0	0.005	0	1.97	14	<0.06	634.0	True	0.05
Zinc	<0.02	620	<0.11	0	<0.11	0	<0.04	0	0.01	0	<0.07	14	<0.02	634.0		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	620	674	0	674	0	583	0	100	0	832	18.5	<37	638.5		100
Ammonia	<0.05	620	20.81	0	<0.12	0	20.81	0	0.05	0	15.2	18.5	<0.49	638.5		TIN=1
Nitrate	<0.06	620	5.2	0	<0.44	0	5.2	0	0.03	0	3.4	18.5	<0.16	638.5		TIN=1
Antimony	<0.003	620	<0.006	0	<0.006	0	0.019	0	0.003	0	<0.019	18.5	<0.003	638.5		0.0056
Copper	<0.001	620	<0.002	0	<0.002	0	<0.019	0	0.002	0	0.015	18.5	<0.001	638.5		0.003
Iron	<0.05	620	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	18.5	<0.05	638.5		0.1
Manganese	<0.02	620	<0.04	0	<0.04	0	0.165	0	0.005	0	2.02	18.5	<0.08	638.5	True	0.05
Zinc	<0.02	620	<0.11	0	<0.11	0	<0.04	0	0.01	0	<0.07	18.5	<0.02	638.5		0.025

RAMSEY CREEK at RA 600
Construction

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	654	658	18	658	0	569	0	100	0	813	0	<30	672		100
Ammonia	<0.05	654	20.31	18	<0.12	0	20.31	0	0.05	0	14.8	0	<0.59	672	True	TIN=1
Nitrate	<0.06	654	50.78	18	<0.43	0	50.78	0	0.03	0	32.7	0	<1.42	672	True	TIN=1
Antimony	<0.003	654	<0.006	18	<0.006	0	0.018	0	0.003	0	<0.018	0	<0.003	672		0.0056
Copper	<0.001	654	<0.002	18	<0.002	0	<0.018	0	0.002	0	0.014	0	<0.001	672		0.003
Iron	<0.05	654	<0.10	18	<0.10	0	0.06	0	0.01	0	<0.08	0	<0.05	672		0.1
Manganese	<0.02	654	<0.04	18	<0.04	0	0.161	0	0.005	0	1.97	0	<0.02	672		0.05
Zinc	<0.02	654	<0.11	18	<0.11	0	<0.04	0	0.01	0	<0.07	0	<0.02	672		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	654	674	29.5	674	0	583	0	100	0	832	0	<42	683.5		100
Ammonia	<0.05	654	20.81	29.5	<0.12	0	20.81	0	0.05	0	15.2	0	<0.95	683.5	True	TIN=1
Nitrate	<0.06	654	5.2	29.5	<0.44	0	5.2	0	0.03	0	3.4	0	<0.28	683.5	True	TIN=1
Antimony	<0.003	654	<0.006	29.5	<0.006	0	0.019	0	0.003	0	<0.019	0	<0.003	683.5		0.0056
Copper	<0.001	654	<0.002	29.5	<0.002	0	<0.019	0	0.002	0	0.015	0	<0.001	683.5		0.003
Iron	<0.05	654	<0.10	29.5	<0.10	0	0.06	0	0.01	0	<0.08	0	<0.05	683.5		0.1
Manganese	<0.02	654	<0.04	29.5	<0.04	0	0.165	0	0.005	0	2.02	0	<0.02	683.5		0.05
Zinc	<0.02	654	<0.11	29.5	<0.11	0	<0.04	0	0.01	0	<0.07	0	<0.02	683.5		0.025

RAMSEY CREEK at RA 600

Mining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	654	658	0	658	6	569	12	100	0	813	0	<29	672		100
Ammonia	<0.05	654	20.31	0	<0.12	6	20.31	12	0.05	0	14.8	0	<0.41	672	True	TIN=1
Nitrate	<0.06	654	50.78	0	<0.43	6	50.78	12	0.03	0	32.7	0	<0.97	672	True	TIN=1
Antimony	<0.003	654	<0.006	0	<0.006	6	0.018	12	0.003	0	<0.018	0	<0.003	672		0.0056
Copper	<0.001	654	<0.002	0	<0.002	6	<0.018	12	0.002	0	0.014	0	<0.001	672		0.003
Iron	<0.05	654	<0.10	0	<0.10	6	0.06	12	0.01	0	<0.08	0	<0.05	672		0.1
Manganese	<0.02	654	<0.04	0	<0.04	6	0.161	12	0.005	0	1.97	0	<0.02	672		0.05
Zinc	<0.02	654	<0.11	0	<0.11	6	<0.04	12	0.01	0	<0.07	0	<0.02	672		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	654	674	0	674	19.5	583	10	100	0	832	0	<40	683.5		100
Ammonia	<0.05	654	20.81	0	<0.12	19.5	20.81	10	0.05	0	15.2	0	<0.36	683.5		TIN=1
Nitrate	<0.06	654	5.2	0	<0.44	19.5	5.2	10	0.03	0	3.4	0	<0.15	683.5		TIN=1
Antimony	<0.003	654	<0.006	0	<0.006	19.5	0.019	10	0.003	0	<0.019	0	<0.003	683.5		0.0056
Copper	<0.001	654	<0.002	0	<0.002	19.5	<0.019	10	0.002	0	0.015	0	<0.001	683.5		0.003
Iron	<0.05	654	<0.10	0	<0.10	19.5	0.06	10	0.01	0	<0.08	0	<0.05	683.5		0.1
Manganese	<0.02	654	<0.04	0	<0.04	19.5	0.165	10	0.005	0	2.02	0	<0.02	683.5		0.05
Zinc	<0.02	654	<0.11	0	<0.11	19.5	<0.04	10	0.01	0	<0.07	0	<0.02	683.5		0.025

RAMSEY CREEK at RA 600
Postmining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	654	658	0	658	0	569	0	100	0	813	18	<34	672		100
Ammonia	<0.05	654	20.31	0	<0.12	0	20.31	0	0.05	0	14.8	18	<0.45	672	True	TIN=1
Nitrate	<0.06	654	50.78	0	<0.43	0	50.78	0	0.03	0	32.7	18	<0.93	672	True	TIN=1
Antimony	<0.003	654	<0.006	0	<0.006	0	0.018	0	0.003	0	<0.018	18	<0.003	672		0.0056
Copper	<0.001	654	<0.002	0	<0.002	0	<0.018	0	0.002	0	0.014	18	<0.001	672		0.003
Iron	<0.05	654	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	18	<0.05	672		0.1
Manganese	<0.02	654	<0.04	0	<0.04	0	0.161	0	0.005	0	1.97	18	<0.07	672	True	0.05
Zinc	<0.02	654	<0.11	0	<0.11	0	<0.04	0	0.01	0	<0.07	18	<0.02	672		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<13	654	674	0	674	0	583	0	100	0	832	29.5	<48	683.5		100
Ammonia	<0.05	654	20.81	0	<0.12	0	20.81	0	0.05	0	15.2	29.5	<0.70	683.5		TIN=1
Nitrate	<0.06	654	5.2	0	<0.44	0	5.2	0	0.03	0	3.4	29.5	<0.20	683.5		TIN=1
Antimony	<0.003	654	<0.006	0	<0.006	0	0.019	0	0.003	0	<0.019	29.5	<0.004	683.5		0.0056
Copper	<0.001	654	<0.002	0	<0.002	0	<0.019	0	0.002	0	0.015	29.5	<0.002	683.5		0.003
Iron	<0.05	654	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	29.5	<0.05	683.5		0.1
Manganese	<0.02	654	<0.04	0	<0.04	0	0.165	0	0.005	0	2.02	29.5	<0.11	683.5	True	0.05
Zinc	<0.02	654	<0.11	0	<0.11	0	<0.04	0	0.01	0	<0.07	29.5	<0.02	683.5		0.025

POORMAN CREEK at PM 1000
Construction

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	436	674	3.4	674	0	583	0	100	0	832	0	<25	439.4		100
Ammonia	<0.05	436	20.81	3.4	<0.12	0	20.81	0	0.05	0	15.2	0	<0.21	439.4		TIN=1
Nitrate	<0.05	436	5.2	3.4	<0.44	0	5.2	0	0.03	0	3.4	0	<0.09	439.4		TIN=1
Antimony	<0.003	436	<0.006	3.4	<0.006	0	0.019	0	0.003	0	<0.019	0	<0.003	439.4		0.0056
Copper	<0.001	436	<0.002	3.4	<0.002	0	<0.019	0	0.002	0	0.015	0	<0.001	439.4		0.003
Iron	<0.05	436	<0.10	3.4	<0.10	0	0.06	0	0.01	0	<0.08	0	<0.05	439.4		0.1
Manganese	<0.02	436	<0.04	3.4	<0.04	0	0.165	0	0.005	0	2.02	0	<0.02	439.4		0.05
Zinc	<0.02	436	<0.11	3.4	<0.11	0	<0.04	0	0.01	0	<0.07	0	<0.02	439.4		0.025

POORMAN CREEK at PM 1000

Mining

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	436	674	0	674	1.15	583	2.25	100	0	832	0	<25	439.4		100
Ammonia	<0.05	436	20.81	0	<0.12	1.15	20.81	2.25	0.05	0	15.2	0	<0.16	439.4		TIN=1
Nitrate	<0.05	436	5.2	0	<0.44	1.15	5.2	2.25	0.03	0	3.4	0	<0.08	439.4		TIN=1
Antimony	<0.003	436	<0.006	0	<0.006	1.15	0.019	2.25	0.003	0	<0.019	0	<0.003	439.4		0.0056
Copper	<0.001	436	<0.002	0	<0.002	1.15	<0.019	2.25	0.002	0	0.015	0	<0.001	439.4		0.003
Iron	<0.05	436	<0.10	0	<0.10	1.15	0.06	2.25	0.01	0	<0.08	0	<0.05	439.4		0.1
Manganese	<0.02	436	<0.04	0	<0.04	1.15	0.165	2.25	0.005	0	2.02	0	<0.02	439.4		0.05
Zinc	<0.02	436	<0.11	0	<0.11	1.15	<0.04	2.25	0.01	0	<0.07	0	<0.02	439.4		0.025

POORMAN CREEK at PM 1000

Postmining

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	436	674	0	674	0	583	0	100	0	832	3.4	<26	439.4		100
Ammonia	<0.05	436	20.81	0	<0.12	0	20.81	0	0.05	0	15.2	3.4	<0.17	439.4		TIN=1
Nitrate	<0.05	436	5.2	0	<0.44	0	5.2	0	0.03	0	3.4	3.4	<0.08	439.4		TIN=1
Antimony	<0.003	436	<0.006	0	<0.006	0	0.019	0	0.003	0	<0.019	3.4	<0.003	439.4		0.0056
Copper	<0.001	436	<0.002	0	<0.002	0	<0.019	0	0.002	0	0.015	3.4	<0.001	439.4		0.003
Iron	<0.05	436	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	3.4	<0.05	439.4		0.1
Manganese	<0.02	436	<0.04	0	<0.04	0	0.165	0	0.005	0	2.02	3.4	<0.04	439.4		0.05
Zinc	<0.02	436	<0.11	0	<0.11	0	<0.04	0	0.01	0	<0.07	3.4	<0.02	439.4		0.025

POORMAN CREEK at PM 1200

Construction

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	443	658	9	658	0	569	0	100	0	813	0	<33	452		100
Ammonia	<0.05	443	20.31	9	<0.12	0	20.31	0	0.05	0	14.8	0	<0.45	452	True	TIN=1
Nitrate	<0.05	443	50.78	9	<0.43	0	50.78	0	0.03	0	32.7	0	<1.06	452	True	TIN=1
Antimony	<0.003	443	<0.006	9	<0.006	0	0.018	0	0.003	0	<0.018	0	<0.003	452		0.0056
Copper	<0.001	443	<0.002	9	<0.002	0	<0.018	0	0.002	0	0.014	0	<0.001	452		0.003
Iron	<0.05	443	<0.10	9	<0.10	0	0.06	0	0.01	0	<0.08	0	<0.05	452		0.1
Manganese	<0.02	443	<0.04	9	<0.04	0	0.161	0	0.005	0	1.97	0	<0.02	452		0.05
Zinc	<0.02	443	<0.11	9	<0.11	0	<0.04	0	0.01	0	<0.07	0	<0.02	452		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	443	674	14.1	674	0	583	0	100	0	832	0	<40	457.1		100
Ammonia	<0.05	443	20.81	14.1	<0.12	0	20.81	0	0.05	0	15.2	0	<0.69	457.1		TIN=1
Nitrate	<0.05	443	5.2	14.1	<0.44	0	5.2	0	0.03	0	3.4	0	<0.21	457.1		TIN=1
Antimony	<0.003	443	<0.006	14.1	<0.006	0	0.019	0	0.003	0	<0.019	0	<0.003	457.1		0.0056
Copper	<0.001	443	<0.002	14.1	<0.002	0	<0.019	0	0.002	0	0.015	0	<0.001	457.1		0.003
Iron	<0.05	443	<0.10	14.1	<0.10	0	0.06	0	0.01	0	<0.08	0	<0.05	457.1		0.1
Manganese	<0.02	443	<0.04	14.1	<0.04	0	0.165	0	0.005	0	2.02	0	<0.02	457.1		0.05
Zinc	<0.02	443	<0.11	14.1	<0.11	0	<0.04	0	0.01	0	<0.07	0	<0.02	457.1		0.025

POORMAN CREEK at PM 1200
Mining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	443	658	0	658	3	569	6	100		813		<32	452.0		100
Ammonia	<0.05	443	20.31	0	<0.12	3	20.31	6	0.05	0	14.8	0	<0.32	452.0	True	TIN=1
Nitrate	<0.05	443	50.78	0	<0.43	3	50.78	6	0.03	0	32.7	0	<0.73	452.0	True	TIN=1
Antimony	<0.003	443	<0.006	0	<0.006	3	0.018	6	0.003	0	<0.018	0	<0.003	452.0		0.0056
Copper	<0.001	443	<0.002	0	<0.002	3	<0.018	6	0.002	0	0.014	0	<0.001	452.0		0.003
Iron	<0.05	443	<0.10	0	<0.10	3	0.06	6	0.01	0	<0.08	0	<0.05	452.0		0.1
Manganese	<0.02	443	<0.04	0	<0.04	3	0.161	6	0.005	0	1.97	0	<0.02	452.0		0.05
Zinc	<0.02	443	<0.11	0	<0.11	3	<0.04	6	0.01	0	<0.07	0	<0.02	452.0		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	443	674	0	674	4.8	583	9.3	100		832		<38	457.1		100
Ammonia	<0.05	443	20.81	0	<0.12	4.8	20.81	9.3	0.05	0	15.2	0	<0.47	457.1		TIN=1
Nitrate	<0.05	443	5.2	0	<0.44	4.8	5.2	9.3	0.03	0	3.4	0	<0.16	457.1		TIN=1
Antimony	<0.003	443	<0.006	0	<0.006	4.8	0.019	9.3	0.003	0	<0.019	0	<0.003	457.1		0.0056
Copper	<0.001	443	<0.002	0	<0.002	4.8	<0.019	9.3	0.002	0	0.015	0	<0.001	457.1		0.003
Iron	<0.05	443	<0.10	0	<0.10	4.8	0.06	9.3	0.01	0	<0.08	0	<0.05	457.1		0.1
Manganese	<0.02	443	<0.04	0	<0.04	4.8	0.165	9.3	0.005	0	2.02	0	<0.02	457.1		0.05
Zinc	<0.02	443	<0.11	0	<0.11	4.8	<0.04	9.3	0.01	0	<0.07	0	<0.02	457.1		0.025

POORMAN CREEK at PM 1200
Postmining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	443	658	0	658	0	569	0	100	0	813	9	<36	452		100
Ammonia	<0.05	443	20.31	0	<0.12	0	20.31	0	0.05	0	14.8	9	<0.34	452	True	TIN=1
Nitrate	<0.05	443	50.78	0	<0.43	0	50.78	0	0.03	0	32.7	9	<0.70	452	True	TIN=1
Antimony	<0.003	443	<0.006	0	<0.006	0	0.018	0	0.003	0	<0.018	9	<0.003	452		0.0056
Copper	<0.001	443	<0.002	0	<0.002	0	<0.018	0	0.002	0	0.014	9	<0.001	452		0.003
Iron	<0.05	443	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	9	<0.05	452		0.1
Manganese	<0.02	443	<0.04	0	<0.04	0	0.161	0	0.005	0	1.97	9	<0.06	452	True	0.05
Zinc	<0.02	443	<0.11	0	<0.11	0	<0.04	0	0.01	0	<0.07	9	<0.02	452		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<20	443	674	0	674	0	583	0	100	0	832	14.1	<45	457.1		100
Ammonia	<0.05	443	20.81	0	<0.12	0	20.81	0	0.05	0	15.2	14.1	<0.52	457.1		TIN=1
Nitrate	<0.05	443	5.2	0	<0.44	0	5.2	0	0.03	0	3.4	14.1	<0.15	457.1		TIN=1
Antimony	<0.003	443	<0.006	0	<0.006	0	0.019	0	0.003	0	<0.019	14.1	<0.003	457.1		0.0056
Copper	<0.001	443	<0.002	0	<0.002	0	<0.019	0	0.002	0	0.015	14.1	<0.001	457.1		0.003
Iron	<0.05	443	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	14.1	<0.05	457.1		0.1
Manganese	<0.02	443	<0.04	0	<0.04	0	0.165	0	0.005	0	2.02	14.1	<0.08	457.1	True	0.05
Zinc	<0.02	443	<0.11	0	<0.11	0	<0.04	0	0.01	0	<0.07	14.1	<0.02	457.1		0.025

LIBBY CREEK at LB 300
Construction

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<18	996	658	0	658	0	569	0	100	345	813	0	<39	1341		100
Ammonia	<0.05	996	20.31	0	<0.12	0	20.31	0	0.05	345	14.8	0	<0.05	1341		TIN=1
Nitrate	<0.12	996	50.78	0	<0.43	0	50.78	0	0.03	345	32.7	0	<0.10	1341		TIN=1
Antimony	<0.003	996	<0.006	0	<0.006	0	0.018	0	0.003	345	<0.018	0	<0.003	1341		0.0056
Copper	<0.001	996	<0.002	0	<0.002	0	<0.018	0	0.002	345	0.014	0	<0.001	1341		0.003
Iron	<0.05	996	<0.10	0	<0.10	0	0.06	0	0.01	345	<0.08	0	<0.04	1341		0.1
Manganese	<0.02	996	<0.04	0	<0.04	0	0.161	0	0.005	345	1.97	0	<0.02	1341		0.05
Zinc	<0.02	996	<0.11	0	<0.11	0	<0.04	0	0.01	345	<0.07	0	<0.02	1341		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<18	996	674	0	674	0	583	0	100	201	832	0	<32	1197		100
Ammonia	<0.05	996	20.81	0	<0.12	0	20.81	0	0.05	201	15.2	0	<0.05	1197		TIN=1
Nitrate	<0.12	996	5.2	0	<0.44	0	5.2	0	0.03	201	3.4	0	<0.10	1197		TIN=1
Antimony	<0.003	996	<0.006	0	<0.006	0	0.019	0	0.003	201	<0.019	0	<0.003	1197		0.0056
Copper	<0.001	996	<0.002	0	<0.002	0	<0.019	0	0.002	201	0.015	0	<0.001	1197		0.003
Iron	<0.05	996	<0.10	0	<0.10	0	0.06	0	0.01	201	<0.08	0	<0.04	1197		0.1
Manganese	<0.02	996	<0.04	0	<0.04	0	0.165	0	0.005	201	2.02	0	<0.02	1197		0.05
Zinc	<0.02	996	<0.11	0	<0.11	0	<0.04	0	0.01	201	<0.07	0	<0.02	1197		0.025

LIBBY CREEK at LB 300

Mining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<18	996	658	0	658	0	569	0	100	164	813	0	<30	1160		100
Ammonia	<0.05	996	20.31	0	<0.12	0	20.31	0	0.05	164	14.8	0	<0.05	1160		TIN=1
Nitrate	<0.12	996	50.78	0	<0.43	0	50.78	0	0.03	164	32.7	0	<0.11	1160		TIN=1
Antimony	<0.003	996	<0.006	0	<0.006	0	0.018	0	0.003	164	<0.018	0	<0.003	1160		0.0056
Copper	<0.001	996	<0.002	0	<0.002	0	<0.018	0	0.002	164	0.014	0	<0.001	1160		0.003
Iron	<0.05	996	<0.10	0	<0.10	0	0.06	0	0.01	164	<0.08	0	<0.04	1160		0.1
Manganese	<0.02	996	<0.04	0	<0.04	0	0.161	0	0.005	164	1.97	0	<0.02	1160		0.05
Zinc	<0.02	996	<0.11	0	<0.11	0	<0.04	0	0.01	164	<0.07	0	<0.02	1160		0.025

Alternative 3

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<18	996	674	0	674	0.00	583	0	100	350	832	0	<39	1346		100
Ammonia	<0.05	996	20.81	0	<0.12	0.00	20.81	0	0.05	350	15.2	0	<0.05	1346		TIN=1
Nitrate	<0.12	996	5.2	0	<0.44	0.00	5.2	0	0.03	350	3.4	0	<0.10	1346		TIN=1
Antimony	<0.003	996	<0.006	0	<0.006	0.00	0.019	0	0.003	350	<0.019	0	<0.003	1346		0.0056
Copper	<0.001	996	<0.002	0	<0.002	0.00	<0.019	0	0.002	350	0.015	0	<0.001	1346		0.003
Iron	<0.05	996	<0.10	0	<0.10	0.00	0.06	0	0.01	350	<0.08	0	<0.04	1346		0.1
Manganese	<0.02	996	<0.04	0	<0.04	0.00	0.165	0	0.005	350	2.02	0	<0.02	1346		0.05
Zinc	<0.02	996	<0.11	0	<0.11	0.00	<0.04	0	0.01	350	<0.07	0	<0.02	1346		0.025

Alternative 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<18	996	674	0	674	0.00	583	0.00	100	130	832	0	<27	1126		100
Ammonia	<0.05	996	21	0	<0.12	0.00	20.81	0.00	0.05	130	15.2	0	<0.05	1126		TIN=1
Nitrate	<0.12	996	5	0	<0.44	0.00	5.2	0.00	0.03	130	3.4	0	<0.11	1126		TIN=1
Antimony	<0.003	996	<0.006	0	<0.006	0.00	0.019	0.00	0.003	130	<0.019	0	<0.003	1126		0.0056
Copper	<0.001	996	<0.002	0	<0.002	0.00	0.019	0.00	0.002	130	0.015	0	<0.001	1126		0.003
Iron	<0.05	996	<0.10	0	<0.10	0.00	0.06	0.00	0.01	130	<0.08	0	<0.05	1126		0.1
Manganese	<0.02	996	<0.04	0	<0.04	0.00	0.165	0.00	0.005	130	2.02	0	<0.02	1126		0.05
Zinc	<0.02	996	<0.11	0	<0.11	0.00	0.04	0.00	0.01	130	<0.07	0	<0.02	1126		0.025

LIBBY CREEK at LB 300
Postmining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<18	996	658	0	658	0	569	0	100	35	813	0	<21	1031		100
Ammonia	<0.05	996	20.31	0	<0.12	0	20.31	0	0.05	35	14.8	0	<0.05	1031		TIN=1
Nitrate	<0.12	996	50.78	0	<0.43	0	50.78	0	0.03	35	32.7	0	<0.12	1031		TIN=1
Antimony	<0.003	996	<0.006	0	<0.006	0	0.018	0	0.003	35	<0.018	0	<0.003	1031		0.0056
Copper	<0.001	996	<0.002	0	<0.002	0	<0.018	0	0.002	35	0.014	0	<0.001	1031		0.003
Iron	<0.05	996	<0.10	0	<0.10	0	0.06	0	0.01	35	<0.08	0	<0.05	1031		0.1
Manganese	<0.02	996	<0.04	0	<0.04	0	0.161	0	0.005	35	1.97	0	<0.02	1031		0.05
Zinc	<0.02	996	<0.11	0	<0.11	0	<0.04	0	0.01	35	<0.07	0	<0.02	1031		0.025

Alternative 3

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<18	996	674	0	674	0	583	0	100	291	832	0	<37	1287		100
Ammonia	<0.05	996	20.81	0	<0.12	0	20.81	0	0.05	291	15.2	0	<0.05	1287		TIN=1
Nitrate	<0.12	996	5.2	0	<0.44	0	5.2	0	0.03	291	3.4	0	<0.10	1287		TIN=1
Antimony	<0.003	996	<0.006	0	<0.006	0	0.019	0	0.003	291	<0.019	0	<0.003	1287		0.0056
Copper	<0.001	996	<0.002	0	<0.002	0	<0.019	0	0.002	291	0.015	0	<0.001	1287		0.003
Iron	<0.05	996	<0.10	0	<0.10	0	0.06	0	0.01	291	<0.08	0	<0.04	1287		0.1
Manganese	<0.02	996	<0.04	0	<0.04	0	0.165	0	0.005	291	2.02	0	<0.02	1287		0.05
Zinc	<0.02	996	<0.11	0	<0.11	0	<0.04	0	0.01	291	<0.07	0	<0.02	1287		0.025

Alternative 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<18	996	674	0	674	0	583	0	100	0	832	0	<18	996		100
Ammonia	<0.05	996	21	0	<0.12	0	20.81	0	0.05	0	15.2	0	<0.05	996		TIN=1
Nitrate	<0.12	996	5	0	<0.44	0	5.2	0	0.03	0	3.4	0	<0.12	996		TIN=1
Antimony	<0.003	996	<0.006	0	<0.006	0	0.019	0	0.003	0	<0.019	0	<0.003	996		0.0056
Copper	<0.001	996	<0.002	0	<0.002	0	0.019	0	0.002	0	0.015	0	<0.001	996		0.003
Iron	<0.05	996	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	0	<0.05	996		0.1
Manganese	<0.02	996	<0.04	0	<0.04	0	0.165	0	0.005	0	2.02	0	<0.02	996		0.05
Zinc	<0.02	996	<0.11	0	<0.11	0	0.04	0	0.01	0	<0.07	0	<0.02	996		0.025

LIBBY CREEK at LB 800
Construction

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	18	2175	658	23	658	0	569	0	100	475	813	0	38	2673		100
Ammonia	<0.05	2175	20.31	23	<0.12	0	20.31	0	0.05	475	14.8	0	<0.22	2673		TIN=1
Nitrate	0.04	2175	50.78	23	<0.43	0	50.78	0	0.03	475	32.7	0	0.47	2673		TIN=1
Antimony	<0.003	2175	<0.006	23	<0.006	0	0.018	0	0.003	475	<0.018	0	<0.003	2673		0.0056
Copper	<0.001	2175	<0.002	23	<0.002	0	<0.018	0	0.002	475	0.014	0	<0.001	2673		0.003
Iron	<0.05	2175	<0.10	23	<0.10	0	0.06	0	0.01	475	<0.08	0	<0.04	2673		0.1
Manganese	<0.02	2175	<0.04	23	<0.04	0	0.161	0	0.005	475	1.97	0	<0.02	2673		0.05
Zinc	<0.02	2175	<0.11	23	<0.11	0	<0.04	0	0.01	475	<0.07	0	<0.02	2673		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	18	2175	674	33.2	674	0	583	0	100	201	832	0	34	2409		100
Ammonia	<0.05	2175	20.81	33.2	<0.12	0	20.81	0	0.05	201	15.2	0	<0.34	2409		TIN=1
Nitrate	0.04	2175	5.2	33.2	<0.44	0	5.2	0	0.03	201	3.4	0	0.11	2409		TIN=1
Antimony	<0.003	2175	<0.006	33.2	<0.006	0	0.019	0	0.003	201	<0.019	0	<0.003	2409		0.0056
Copper	<0.001	2175	<0.002	33.2	<0.002	0	<0.019	0	0.002	201	0.015	0	<0.001	2409		0.003
Iron	<0.05	2175	<0.10	33.2	<0.10	0	0.06	0	0.01	201	<0.08	0	<0.05	2409		0.1
Manganese	<0.02	2175	<0.04	33.2	<0.04	0	0.165	0	0.005	201	2.02	0	<0.02	2409		0.05
Zinc	<0.02	2175	<0.11	33.2	<0.11	0	<0.04	0	0.01	201	<0.07	0	<0.02	2409		0.025

LIBBY CREEK at LB 800
Mining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	18	2175	658	0	658	7.8	569	15.2	100	164	813	0	29	2362		100
Ammonia	<0.05	2175	20.31	0	<0.12	7.8	20.31	15.2	0.05	164	14.8	0	<0.18	2362		TIN=1
Nitrate	0.04	2175	50.78	0	<0.43	7.8	50.78	15.2	0.03	164	32.7	0	<0.37	2362		TIN=1
Antimony	<0.003	2175	<0.006	0	<0.006	7.8	0.018	15.2	0.003	164	<0.018	0	<0.003	2362		0.0056
Copper	<0.001	2175	<0.002	0	<0.002	7.8	<0.018	15.2	0.002	164	0.014	0	<0.001	2362		0.003
Iron	<0.05	2175	<0.10	0	<0.10	7.8	0.06	15.2	0.01	164	<0.08	0	<0.05	2362		0.1
Manganese	<0.02	2175	<0.04	0	<0.04	7.8	0.161	15.2	0.005	164	1.97	0	<0.02	2362		0.05
Zinc	<0.02	2175	<0.11	0	<0.11	7.8	<0.04	15.2	0.01	164	<0.07	0	<0.02	2362		0.025

Alternative 3

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	18	2175	674	0	674	11.1	583	22.1	100	350	832	0	37	2558		100
Ammonia	<0.05	2175	20.81	0	<0.12	11.1	20.81	22.1	0.05	350	15.2	0	<0.23	2558		TIN=1
Nitrate	0.04	2175	5.2	0	<0.44	11.1	5.2	22.1	0.03	350	3.4	0	<0.08	2558		TIN=1
Antimony	<0.003	2175	<0.006	0	<0.006	11.1	0.019	22.1	0.003	350	<0.019	0	<0.003	2558		0.0056
Copper	<0.001	2175	<0.002	0	<0.002	11.1	<0.019	22.1	0.002	350	0.015	0	<0.001	2558		0.003
Iron	<0.05	2175	<0.10	0	<0.10	11.1	0.06	22.1	0.01	350	<0.08	0	<0.04	2558		0.1
Manganese	<0.02	2175	<0.04	0	<0.04	11.1	0.165	22.1	0.005	350	2.02	0	<0.02	2558		0.05
Zinc	<0.02	2175	<0.11	0	<0.11	11.1	<0.04	22.1	0.01	350	<0.07	0	<0.02	2558		0.025

Alternative 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	18	2175	674	0	674	11.1	583	11.1	100	130	832	0	28	2327		100
Ammonia	<0.05	2175	21	0	<0.12	11.1	20.81	11.1	0.05	130	15.2	0	<0.15	2327		TIN=1
Nitrate	0.04	2175	5	0	<0.44	11.1	5.2	11.1	0.03	130	3.4	0	<0.07	2327		TIN=1
Antimony	<0.003	2175	<0.006	0	<0.006	11.1	0.019	11.1	0.003	130	<0.019	0	<0.003	2327		0.0056
Copper	<0.001	2175	<0.002	0	<0.002	11.1	0.019	11.1	0.002	130	0.015	0	<0.001	2327		0.003
Iron	<0.05	2175	<0.10	0	<0.10	11.1	0.06	11.1	0.01	130	<0.08	0	<0.05	2327		0.1
Manganese	<0.02	2175	<0.04	0	<0.04	11.1	0.165	11.1	0.005	130	2.02	0	<0.02	2327		0.05
Zinc	<0.02	2175	<0.11	0	<0.11	11.1	0.04	11.1	0.01	130	<0.07	0	<0.02	2327		0.025

LIBBY CREEK at LB 800

Postmining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	18	2175	658	0	658	0	569	0	100	35	813	23	27	2233		100
Ammonia	<0.05	2175	20.31	0	<0.12	0	20.31	0	0.05	35	14.8	23	<0.20	2233		TIN=1
Nitrate	0.04	2175	50.78	0	<0.43	0	50.78	0	0.03	35	32.7	23	0.38	2233		TIN=1
Antimony	<0.003	2175	<0.006	0	<0.006	0	0.018	0	0.003	35	<0.018	23	<0.003	2233		0.0056
Copper	<0.001	2175	<0.002	0	<0.002	0	<0.018	0	0.002	35	0.014	23	<0.001	2233		0.003
Iron	<0.05	2175	<0.10	0	<0.10	0	0.06	0	0.01	35	<0.08	23	<0.05	2233		0.1
Manganese	<0.02	2175	<0.04	0	<0.04	0	0.161	0	0.005	35	1.97	23	<0.04	2233		0.05
Zinc	<0.02	2175	<0.11	0	<0.11	0	<0.04	0	0.01	35	<0.07	23	<0.02	2233		0.025

Alternative 3

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	18	2175	674	0	674	0	583	0	100	291	832	33.2	38	2499		100
Ammonia	<0.05	2175	20.81	0	<0.12	0	20.81	0	0.05	291	15.2	33.2	<0.25	2499		TIN=1
Nitrate	0.04	2175	5.2	0	<0.44	0	5.2	0	0.03	291	3.4	33.2	0.08	2499		TIN=1
Antimony	<0.003	2175	<0.006	0	<0.006	0	0.019	0	0.003	291	<0.019	33.2	<0.003	2499		0.0056
Copper	<0.001	2175	<0.002	0	<0.002	0	<0.019	0	0.002	291	0.015	33.2	<0.001	2499		0.003
Iron	<0.05	2175	<0.10	0	<0.10	0	0.06	0	0.01	291	<0.08	33.2	<0.05	2499		0.1
Manganese	<0.02	2175	<0.04	0	<0.04	0	0.165	0	0.005	291	2.02	33.2	<0.04	2499		0.05
Zinc	<0.02	2175	<0.11	0	<0.11	0	<0.04	0	0.01	291	<0.07	33.2	<0.02	2499		0.025

Alternative 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	18	2175	674	0	674	0	583	0	100	0	832	33.2	30	2208		100
Ammonia	<0.05	2175	21	0	<0.12	0	20.81	0	0.05	0	15.2	33.2	<0.28	2208		TIN=1
Nitrate	0.04	2175	5	0	<0.44	0	5.2	0	0.03	0	3.4	33.2	0.09	2208		TIN=1
Antimony	<0.003	2175	<0.006	0	<0.006	0	0.019	0	0.003	0	<0.019	33.2	<0.003	2208		0.0056
Copper	<0.001	2175	<0.002	0	<0.002	0	0.019	0	0.002	0	0.015	33.2	<0.001	2208		0.003
Iron	<0.05	2175	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	33.2	<0.05	2208		0.1
Manganese	<0.02	2175	<0.04	0	<0.04	0	0.165	0	0.005	0	2.02	33.2	<0.05	2208		0.05
Zinc	<0.02	2175	<0.11	0	<0.11	0	0.04	0	0.01	0	<0.07	33.2	<0.02	2208		0.025

LIBBY CREEK at LB 1000
Construction

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<30	2936	658	32	658	0	569	0	100	475	813	0	<45	3443		100
Ammonia	<0.05	2936	20.31	32	<0.12	0	20.31	0	0.05	475	14.8	0	<0.24	3443		TIN=1
Nitrate	0.05	2936	50.78	32	<0.43	0	50.78	0	0.03	475	32.7	0	0.52	3443		TIN=1
Antimony	<0.004	2936	<0.006	32	<0.006	0	0.018	0	0.003	475	<0.018	0	<0.004	3443		0.0056
Copper	<0.001	2936	<0.002	32	<0.002	0	<0.018	0	0.002	475	0.014	0	<0.001	3443		0.003
Iron	<0.05	2936	<0.10	32	<0.10	0	0.06	0	0.01	475	<0.08	0	<0.04	3443		0.1
Manganese	<0.02	2936	<0.04	32	<0.04	0	0.161	0	0.005	475	1.97	0	<0.02	3443		0.05
Zinc	<0.02	2936	<0.11	32	<0.11	0	<0.04	0	0.01	475	<0.07	0	<0.02	3443		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<30	2936	674	47.3	674	0	583	0	100	201	832	0	<44	3184		100
Ammonia	<0.05	2936	20.81	47.3	<0.12	0	20.81	0	0.05	201	15.2	0	<0.36	3184		TIN=1
Nitrate	0.05	2936	5.2	47.3	<0.44	0	5.2	0	0.03	201	3.4	0	0.13	3184		TIN=1
Antimony	<0.004	2936	<0.006	47.3	<0.006	0	0.019	0	0.003	201	<0.019	0	<0.004	3184		0.0056
Copper	<0.001	2936	<0.002	47.3	<0.002	0	<0.019	0	0.002	201	0.015	0	<0.001	3184		0.003
Iron	<0.05	2936	<0.10	47.3	<0.10	0	0.06	0	0.01	201	<0.08	0	<0.05	3184		0.1
Manganese	<0.02	2936	<0.04	47.3	<0.04	0	0.165	0	0.005	201	2.02	0	<0.02	3184		0.05
Zinc	<0.02	2936	<0.11	47.3	<0.11	0	<0.04	0	0.01	201	<0.07	0	<0.02	3184		0.025

LIBBY CREEK at LB 1000

Mining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<30	2936	658	0	658	10.9	569	21.1	100	164	813	0	<39	3132		100
Ammonia	<0.05	2936	20.31	0	<0.12	10.9	20.31	21.1	0.05	164	14.8	0	<0.19	3132		TIN=1
Nitrate	0.05	2936	50.78	0	<0.43	10.9	50.78	21.1	0.03	164	32.7	0	<0.39	3132		TIN=1
Antimony	<0.004	2936	<0.006	0	<0.006	10.9	0.018	21.1	0.003	164	<0.018	0	<0.004	3132		0.0056
Copper	<0.001	2936	<0.002	0	<0.002	10.9	<0.018	21.1	0.002	164	0.014	0	<0.001	3132		0.003
Iron	<0.05	2936	<0.10	0	<0.10	10.9	0.06	21.1	0.01	164	<0.08	0	<0.05	3132		0.1
Manganese	<0.02	2936	<0.04	0	<0.04	10.9	0.161	21.1	0.005	164	1.97	0	<0.02	3132		0.05
Zinc	<0.02	2936	<0.11	0	<0.11	10.9	<0.04	21.1	0.01	164	<0.07	0	<0.02	3132		0.025

Alternative 3

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<30	2936	674	0	674	16.1	583	31.2	100	350	832	0	<46	3333		100
Ammonia	<0.05	2936	20.81	0	<0.12	16.1	20.81	31.2	0.05	350	15.2	0	<0.24	3333		TIN=1
Nitrate	0.05	2936	5.2	0	<0.44	16.1	5.2	31.2	0.03	350	3.4	0	<0.10	3333		TIN=1
Antimony	<0.004	2936	<0.006	0	<0.006	16.1	0.019	31.2	0.003	350	<0.019	0	<0.004	3333		0.0056
Copper	<0.001	2936	<0.002	0	<0.002	16.1	<0.019	31.2	0.002	350	0.015	0	<0.001	3333		0.003
Iron	<0.05	2936	<0.10	0	<0.10	16.1	0.06	31.2	0.01	350	<0.08	0	<0.05	3333		0.1
Manganese	<0.02	2936	<0.04	0	<0.04	16.1	0.165	31.2	0.005	350	2.02	0	<0.02	3333		0.05
Zinc	<0.02	2936	<0.11	0	<0.11	16.1	<0.04	31.2	0.01	350	<0.07	0	<0.02	3333		0.025

Alternative 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<30	2936	674	0	674	16.1	583	31.2	100	130	832	0	<42	3113		100
Ammonia	<0.05	2936	21	0	<0.12	16.1	20.81	31.2	0.05	130	15.2	0	<0.26	3113		TIN=1
Nitrate	0.05	2936	5	0	<0.44	16.1	5.2	31.2	0.03	130	3.4	0	<0.10	3113		TIN=1
Antimony	<0.004	2936	<0.006	0	<0.006	16.1	0.019	31.2	0.003	130	<0.019	0	<0.004	3113		0.0056
Copper	<0.001	2936	<0.002	0	<0.002	16.1	0.019	31.2	0.002	130	0.015	0	<0.001	3113		0.003
Iron	<0.05	2936	<0.10	0	<0.10	16.1	0.06	31.2	0.01	130	<0.08	0	<0.05	3113		0.1
Manganese	<0.02	2936	<0.04	0	<0.04	16.1	0.165	31.2	0.005	130	2.02	0	<0.02	3113		0.05
Zinc	<0.02	2936	<0.11	0	<0.11	16.1	0.04	31.2	0.01	130	<0.07	0	<0.02	3113		0.025

LIBBY CREEK at LB 1000

Postmining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<30	2936	658	0	658	0	569	0	100	35	813	32	<39	3003		100
Ammonia	<0.05	2936	20.31	0	<0.12	0	20.31	0	0.05	35	14.8	32	<0.21	3003		TIN=1
Nitrate	0.05	2936	50.78	0	<0.43	0	50.78	0	0.03	35	32.7	32	0.40	3003		TIN=1
Antimony	<0.004	2936	<0.006	0	<0.006	0	0.018	0	0.003	35	<0.018	32	<0.004	3003		0.0056
Copper	<0.001	2936	<0.002	0	<0.002	0	<0.018	0	0.002	35	0.014	32	<0.001	3003		0.003
Iron	<0.05	2936	<0.10	0	<0.10	0	0.06	0	0.01	35	<0.08	32	<0.05	3003		0.1
Manganese	<0.02	2936	<0.04	0	<0.04	0	0.161	0	0.005	35	1.97	32	<0.04	3003		0.05
Zinc	<0.02	2936	<0.11	0	<0.11	0	<0.04	0	0.01	35	<0.07	32	<0.02	3003		0.025

Alternative 3

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<30	2936	674	0	674	0	583	0	100	291	832	47.3	<48	3274		100
Ammonia	<0.05	2936	20.81	0	<0.12	0	20.81	0	0.05	291	15.2	47.3	<0.27	3274		TIN=1
Nitrate	0.05	2936	5.2	0	<0.44	0	5.2	0	0.03	291	3.4	47.3	0.10	3274		TIN=1
Antimony	<0.004	2936	<0.006	0	<0.006	0	0.019	0	0.003	291	<0.019	47.3	<0.004	3274		0.0056
Copper	<0.001	2936	<0.002	0	<0.002	0	<0.019	0	0.002	291	0.015	47.3	<0.001	3274		0.003
Iron	<0.05	2936	<0.10	0	<0.10	0	0.06	0	0.01	291	<0.08	47.3	<0.05	3274		0.1
Manganese	<0.02	2936	<0.04	0	<0.04	0	0.165	0	0.005	291	2.02	47.3	<0.05	3274		0.05
Zinc	<0.02	2936	<0.11	0	<0.11	0	<0.04	0	0.01	291	<0.07	47.3	<0.02	3274		0.025

Alternative 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	<30	2936	674	0	674	0	583	0	100	0	832	47.3	<43	2983		100
Ammonia	<0.05	2936	21	0	<0.12	0	20.81	0	0.05	0	15.2	47.3	<0.29	2983		TIN=1
Nitrate	0.05	2936	5	0	<0.44	0	5.2	0	0.03	0	3.4	47.3	0.10	2983		TIN=1
Antimony	<0.004	2936	<0.006	0	<0.006	0	0.019	0	0.003	0	<0.019	47.3	<0.004	2983		0.0056
Copper	<0.001	2936	<0.002	0	<0.002	0	0.019	0	0.002	0	0.015	47.3	<0.001	2983		0.003
Iron	<0.05	2936	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	47.3	<0.05	2983		0.1
Manganese	<0.02	2936	<0.04	0	<0.04	0	0.165	0	0.005	0	2.02	47.3	<0.05	2983		0.05
Zinc	<0.02	2936	<0.11	0	<0.11	0	0.04	0	0.01	0	<0.07	47.3	<0.02	2983		0.025

LIBBY CREEK at LB 2000

Construction

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	26	3255	658	32	658	0	569	0	100	475	813	0	41	3762		100
Ammonia	<0.05	3255	20.31	32	<0.12	0	20.31	0	0.05	475	14.8	0	<0.22	3762		TIN=1
Nitrate	0.06	3255	50.78	32	<0.43	0	50.78	0	0.03	475	32.7	0	0.49	3762		TIN=1
Antimony	0.002	3255	<0.006	32	<0.006	0	0.018	0	0.003	475	<0.018	0	<0.002	3762		0.0056
Copper	<0.001	3255	<0.002	32	<0.002	0	<0.018	0	0.002	475	0.014	0	<0.001	3762		0.003
Iron	<0.05	3255	<0.10	32	<0.10	0	0.06	0	0.01	475	<0.08	0	<0.05	3762		0.1
Manganese	<0.02	3255	<0.04	32	<0.04	0	0.161	0	0.005	475	1.97	0	<0.02	3762		0.05
Zinc	<0.02	3255	<0.11	32	<0.11	0	<0.04	0	0.01	475	<0.07	0	<0.02	3762		0.025

Alternatives 3 and 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	26	3255	674	47.3	674	0	583	0	100	201	832	0	39	3503		100
Ammonia	<0.05	3255	20.81	47.3	<0.12	0	20.81	0	0.05	201	15.2	0	<0.33	3503		TIN=1
Nitrate	0.06	3255	5.2	47.3	<0.44	0	5.2	0	0.03	201	3.4	0	0.13	3503		TIN=1
Antimony	<0.002	3255	<0.006	47.3	<0.006	0	0.019	0	0.003	201	<0.019	0	<0.002	3503		0.0056
Copper	<0.001	3255	<0.002	47.3	<0.002	0	<0.019	0	0.002	201	0.015	0	<0.001	3503		0.003
Iron	<0.05	3255	<0.10	47.3	<0.10	0	0.06	0	0.01	201	<0.08	0	<0.05	3503		0.1
Manganese	<0.02	3255	<0.04	47.3	<0.04	0	0.165	0	0.005	201	2.02	0	<0.02	3503		0.05
Zinc	<0.02	3255	<0.11	47.3	<0.11	0	<0.04	0	0.01	201	<0.07	0	<0.02	3503		0.025

LIBBY CREEK at LB 2000
Mining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	26	3255	658	0	658	10.9	569	21.12	100	164	813	0	35	3451		100
Ammonia	<0.05	3255	20.31	0	<0.12	10.9	20.31	21.12	0.05	164	14.8	0	<0.17	3451		TIN=1
Nitrate	0.06	3255	50.78	0	<0.43	10.9	50.78	21.12	0.03	164	32.7	0	<0.37	3451		TIN=1
Antimony	0.002	3255	<0.006	0	<0.006	10.9	0.018	21.12	0.003	164	<0.018	0	<0.002	3451		0.0056
Copper	<0.001	3255	<0.002	0	<0.002	10.9	<0.018	21.12	0.002	164	0.014	0	<0.001	3451		0.003
Iron	<0.05	3255	<0.10	0	<0.10	10.9	0.06	21.12	0.01	164	<0.08	0	<0.05	3451		0.1
Manganese	<0.02	3255	<0.04	0	<0.04	10.9	0.161	21.12	0.005	164	1.97	0	<0.02	3451		0.05
Zinc	<0.02	3255	<0.11	0	<0.11	10.9	<0.04	21.12	0.01	164	<0.07	0	<0.02	3451		0.025

Alternative 3

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	26	3255	674	0	674	16.1	583	31.2	100	350	832	0	41	3652		100
Ammonia	<0.05	3255	20.81	0	<0.12	16.1	20.81	31.2	0.05	350	15.2	0	<0.23	3652		TIN=1
Nitrate	0.06	3255	5.2	0	<0.44	16.1	5.2	31.2	0.03	350	3.4	0	<0.10	3652		TIN=1
Antimony	<0.002	3255	<0.006	0	<0.006	16.1	0.019	31.2	0.003	350	<0.019	0	<0.002	3652		0.0056
Copper	<0.001	3255	<0.002	0	<0.002	16.1	<0.019	31.2	0.002	350	0.015	0	<0.001	3652		0.003
Iron	<0.05	3255	<0.10	0	<0.10	16.1	0.06	31.2	0.01	350	<0.08	0	<0.05	3652		0.1
Manganese	<0.02	3255	<0.04	0	<0.04	16.1	0.165	31.2	0.005	350	2.02	0	<0.02	3652		0.05
Zinc	<0.02	3255	<0.11	0	<0.11	16.1	<0.04	31.2	0.01	350	<0.07	0	<0.02	3652		0.025

Alternative 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	26	3255	674	0	674	16.1	583	31.2	100	130	832	0	37	3432		100
Ammonia	<0.05	3255	21	0	<0.12	16.1	20.81	31.2	0.05	130	15.2	0	<0.24	3432		TIN=1
Nitrate	0.06	3255	5	0	<0.44	16.1	5.2	31.2	0.03	130	3.4	0	<0.11	3432		TIN=1
Antimony	<0.002	3255	<0.006	0	<0.006	16.1	0.019	31.2	0.003	130	<0.019	0	<0.002	3432		0.0056
Copper	<0.001	3255	<0.002	0	<0.002	16.1	<0.019	31.2	0.002	130	0.015	0	<0.001	3432		0.003
Iron	<0.05	3255	<0.10	0	<0.10	16.1	0.06	31.2	0.01	130	<0.08	0	<0.05	3432		0.1
Manganese	<0.02	3255	<0.04	0	<0.04	16.1	0.165	31.2	0.005	130	2.02	0	<0.02	3432		0.05
Zinc	<0.02	3255	<0.11	0	<0.11	16.1	<0.04	31.2	0.01	130	<0.07	0	<0.02	3432		0.025

LIBBY CREEK at LB 2000

Postmining

Alternative 2

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	26	3255	658	0	658	0	569	0	100	35	813	32	34	3322		100
Ammonia	<0.05	3255	20.31	0	<0.12	0	20.31	0	0.05	35	14.8	32	<0.19	3322		TIN=1
Nitrate	0.06	3255	50.78	0	<0.43	0	50.78	0	0.03	35	32.7	32	0.37	3322		TIN=1
Antimony	<0.002	3255	<0.006	0	<0.006	0	0.018	0	0.003	35	<0.018	32	<0.002	3322		0.0056
Copper	<0.001	3255	<0.002	0	<0.002	0	<0.018	0	0.002	35	0.014	32	<0.001	3322		0.003
Iron	<0.05	3255	<0.10	0	<0.10	0	0.06	0	0.01	35	<0.08	32	<0.05	3322		0.1
Manganese	<0.02	3255	<0.04	0	<0.04	0	0.161	0	0.005	35	1.97	32	<0.04	3322		0.05
Zinc	<0.02	3255	<0.11	0	<0.11	0	<0.04	0	0.01	35	<0.07	32	<0.02	3322		0.025

Alternative 3

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	26	3255	674	0	674	0	583	0	100	291	832	47.3	43	3593		100
Ammonia	<0.05	3255	20.81	0	<0.12	0	20.81	0	0.05	291	15.2	47.3	<0.25	3593		TIN=1
Nitrate	0.06	3255	5.2	0	<0.44	0	5.2	0	0.03	291	3.4	47.3	0.10	3593		TIN=1
Antimony	<0.002	3255	<0.006	0	<0.006	0	0.019	0	0.003	291	<0.019	47.3	<0.002	3593		0.0056
Copper	<0.001	3255	<0.002	0	<0.002	0	<0.019	0	0.002	291	0.015	47.3	<0.001	3593		0.003
Iron	<0.05	3255	<0.10	0	<0.10	0	0.06	0	0.01	291	<0.08	47.3	<0.05	3593		0.1
Manganese	<0.02	3255	<0.04	0	<0.04	0	0.165	0	0.005	291	2.02	47.3	<0.05	3593		0.05
Zinc	<0.02	3255	<0.11	0	<0.11	0	<0.04	0	0.01	291	<0.07	47.3	<0.02	3593		0.025

Alternative 4

	Existing Water Quality		Expected adit water from LAD percolation (construction)		Expected adit water from LAD percolation (mining)		Expected mine water from LAD percolation		Expected Water Treatment Plant effluent		Expected tailings water from LAD percolation		Projected final mixing concentration		Exceedance	Surface Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	26	3255	674	0	674	0	583	0	100	0	832	47.3	38	3302		100
Ammonia	<0.05	3255	21	0	<0.12	0	20.81	0	0.05	0	15.2	47.3	<0.27	3302		TIN=1
Nitrate	0.06	3255	5	0	<0.44	0	5.2	0	0.03	0	3.4	47.3	0.11	3302		TIN=1
Antimony	<0.002	3255	<0.006	0	<0.006	0	0.019	0	0.003	0	<0.019	47.3	<0.002	3302		0.0056
Copper	<0.001	3255	<0.002	0	<0.002	0	0.019	0	0.002	0	0.015	47.3	<0.001	3302		0.003
Iron	<0.05	3255	<0.10	0	<0.10	0	0.06	0	0.01	0	<0.08	47.3	<0.05	3302		0.1
Manganese	<0.02	3255	<0.04	0	<0.04	0	0.165	0	0.005	0	2.02	47.3	<0.05	3302		0.05
Zinc	<0.02	3255	<0.11	0	<0.11	0	0.04	0	0.01	0	<0.07	47.3	<0.02	3302		0.025

LAD--Construction

Alternative 2

Mass Balance Calculations for ground water below LAD Areas

	Existing Ground Water Conditions		Expected Adit Water Input from LAD Percolation (construction)		Projected Final Mixing Concentration		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	(mg/L)	(mg/L)	(mg/L)
TDS	85	31	658	32	376	63	True	200
Nitrate	<0.49	31	50.78	32	<26.03	63	True	10
Antimony	<0.003	31	<0.006	32	<0.005	63		0.006
Cadmium	<0.0002	31	<0.0006	32	<0.0004	63		0.005
Copper	<0.001	31	<0.002	32	<0.002	63		0.1
Iron	<0.05	31	<0.10	32	<0.08	63		0.2
Lead	<0.001	31	<0.002	32	<0.002	63		0.015
Manganese	<0.04	31	<0.04	32	<0.04	63		0.05
Silver	<0.0002	31	<0.0014	32	<0.001	63		0.1
Zinc	<0.02	31	<0.11	32	<0.07	63		0.1

Alternatives 3 & 4

Mass Balance Calculations for ground water below LAD Areas

	Existing Ground Water Conditions		Expected Adit Water Input from LAD Percolation (construction)		Projected Final Mixing Concentration		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	(mg/L)	(mg/L)	(mg/L)
TDS	85	46	674	47.3	384	93.3	True	200
Nitrate	<0.49	46	5	47.3	<2.88	93.3		10
Antimony	<0.003	46	<0.006	47.3	<0.005	93.3		0.006
Cadmium	<0.0002	46	<0.0006	47.3	<0.0004	93.3		0.005
Copper	<0.001	46	<0.002	47.3	<0.002	93.3		0.1
Iron	<0.05	46	<0.10	47.3	<0.08	93.3		0.2
Lead	<0.001	46	<0.002	47.3	<0.002	93.3		0.015
Manganese	<0.04	46	<0.04	47.3	<0.04	93.3		0.05
Silver	<0.0002	46	<0.0010	47.3	<0.001	93.3		0.1
Zinc	<0.02	46	<0.11	47.3	<0.07	93.3		0.1

LAD--Mining

Alternative 2
Mass Balance Calculations for ground water below LAD Areas

	Existing Ground Water Conditions		Expected Adit Water Input from LAD Percolation (operational)		Expected Mine Water Input from LAD Percolation (operational)		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	85	31	658	10.9	569	21.1	346	63	True	200
Nitrate	<0.49	31	<0.43	10.9	50.78	21.1	<17.32	63	True	10
Antimony	<0.003	31	<0.006	10.9	0.018	21.1	<0.009	63	True	0.006
Cadmium	<0.0002	31	<0.0006	10.9	<0.0004	21.1	<0.0003	63		0.005
Copper	<0.001	31	<0.002	10.9	<0.018	21.1	<0.007	63		0.1
Iron	<0.05	31	<0.10	10.9	0.06	21.1	<0.06	63		0.2
Lead	<0.001	31	<0.002	10.9	<0.001	21.1	<0.001	63		0.015
Manganese	<0.04	31	<0.04	10.9	0.161	21.1	<0.08	63	True	0.05
Silver	<0.0002	31	<0.0014	10.9	<0.006	21.1	<0.002	63		0.1
Zinc	<0.02	31	<0.11	10.9	<0.04	21.1	<0.04	63		0.1

Alternatives 3 & 4
Mass Balance Calculations for ground water below LAD Areas

	Existing Ground Water Conditions		Expected Adit Water Input from LAD Percolation (operational)		Expected Mine Water Input from LAD Percolation (operational)		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	85	46	674	16.1	583	31.2	353	93.3	True	200
Nitrate	<0.49	46	<0.44	16.1	5.2	31.2	<2.06	93.3		10
Antimony	<0.003	46	<0.006	16.1	0.019	31.2	<0.009	93.3	True	0.006
Cadmium	<0.0002	46	<0.0006	16.1	<0.0004	31.2	<0.0003	93.3		0.005
Copper	<0.001	46	<0.002	16.1	<0.019	31.2	<0.007	93.3		0.1
Iron	<0.05	46	<0.10	16.1	0.06	31.2	<0.06	93.3		0.2
Lead	<0.001	46	<0.002	16.1	<0.001	31.2	<0.001	93.3		0.015
Manganese	<0.04	46	<0.04	16.1	0.165	31.2	<0.08	93.3	True	0.05
Silver	<0.0002	46	<0.0015	16.1	<0.006	31.2	<0.002	93.3		0.1
Zinc	<0.02	46	<0.11	16.1	<0.04	31.2	<0.04	93.3		0.1

LAD--Post-Mining

Alternative 2

Mass Balance Calculations for ground water below LAD Areas

	Existing Ground Water Conditions		Expected Tailing Water Input from LAD Percolation (post-mining)		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	85	31	813	32	455	63	True	200
Nitrate	<0.49	31	32.7	32	<16.85	63	True	10
Antimony	<0.003	31	<0.018	32	<0.011	63	True	0.006
Cadmium	<0.0002	31	<0.004	32	<0.0021	63		0.005
Copper	<0.001	31	0.014	32	<0.008	63		0.1
Iron	<0.05	31	<0.08	32	<0.07	63		0.2
Lead	<0.001	31	<0.005	32	<0.003	63		0.015
Manganese	<0.04	31	1.97	32	<1.02	63	True	0.05
Silver	<0.0002	31	<0.008	32	<0.004	63		0.1
Zinc	<0.02	31	<0.07	32	<0.05	63		0.1

Alternatives 3 & 4

Mass Balance Calculations for ground water below LAD Areas

	Existing Ground Water Conditions		Expected Tailing Water Input from LAD Percolation (post-mining)		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	85	32	832	47.3	531	79.3	True	200
Nitrate	<0.49	32	3.4	47.3	<2.20	79.3		10
Antimony	<0.003	32	<0.019	47.3	<0.013	79.3	True	0.006
Cadmium	<0.0002	32	<0.004	47.3	<0.0025	79.3		0.005
Copper	<0.001	32	0.015	47.3	<0.009	79.3		0.1
Iron	<0.05	32	<0.08	47.3	<0.07	79.3		0.2
Lead	<0.001	32	<0.005	47.3	<0.003	79.3		0.015
Manganese	<0.04	32	2.02	47.3	<1.22	79.3	True	0.05
Silver	<0.0002	32	<0.008	47.3	<0.005	79.3		0.1
Zinc	<0.02	32	<0.07	47.3	<0.05	79.3		0.1

TI--Construction

Little Cherry Creek Impoundment Area Well Data Used for Existing Conditions

Alternatives 2 & 4

Mass Balance Calculations for ground water below TI

	Existing Ground water Conditions		Expected Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	99	35	200	11	123	46		200
Nitrate	0.1	35	16.1	11	3.9	46		10
Antimony	<0.003	35	0.009	11	<0.004	46		0.006
Cadmium	<0.001	35	0.002	11	<0.001	46		0.005
Copper	<0.01	35	0.035	11	<0.02	46		0.1
Iron	<0.05	35	<0.04	11	<0.05	46		0.2
Lead	<0.01	35	<0.013	11	<0.01	46		0.015
Manganese	<0.03	35	0.54	11	<0.15	46	True	0.05
Silver	<0.001	35	<0.004	11	<0.002	46		0.1
Zinc	<0.02	35	<0.02	11	<0.02	46		0.1

Poorman Impoundment Area Well Data Used for Existing Conditions

Alternative 3

Mass Balance Calculations for ground water below TI

	Existing Ground water Conditions		Expected Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	102	41	200	11	123	52		200
Nitrate	<0.07	41	16.1	11	<3.5	52		10
Antimony	<0.003	41	0.009	11	<0.004	52		0.006
Cadmium	<0.001	41	0.002	11	<0.001	52		0.005
Copper	<0.01	41	0.035	11	<0.02	52		0.1
Iron	<0.05	41	<0.04	11	<0.05	52		0.2
Lead	<0.01	41	<0.013	11	<0.01	52		0.015
Manganese	<0.02	41	0.54	11	<0.13	52	True	0.05
Silver	<0.001	41	<0.004	11	<0.002	52		0.1
Zinc	<0.02	41	<0.02	11	<0.02	52		0.1

Tailings Impoundment--Mining
Little Cherry Creek Impoundment Area Well Data Used for Existing Conditions

Alternatives 2 & 4
Mass Balance Calculations for ground water below TI

	Existing Ground water Conditions		Expected Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	99	35	200	25	141	60		200
Nitrate	0.1	35	16.1	25	6.8	60		10
Antimony	<0.003	35	0.009	25	<0.006	60		0.006
Cadmium	<0.001	35	0.002	25	<0.001	60		0.005
Copper	<0.01	35	0.035	25	<0.02	60		0.1
Iron	<0.05	35	<0.04	25	<0.05	60		0.2
Lead	<0.01	35	<0.013	25	<0.01	60		0.015
Manganese	<0.03	35	0.54	25	<0.24	60	True	0.05
Silver	<0.001	35	<0.004	25	<0.002	60		0.1
Zinc	<0.02	35	<0.02	25	<0.02	60		0.1

Poorman Impoundment Area Well Data Used for Existing Conditions
Alternative 3
Mass Balance Calculations for ground water below TI

	Existing Ground water Conditions		Expected Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	102	41	200	25	139	66		200
Nitrate	<0.07	41	16.1	25	<6.1	66		10
Antimony	<0.003	41	0.009	25	<0.005	66		0.006
Cadmium	<0.001	41	0.002	25	<0.001	66		0.005
Copper	<0.01	41	0.035	25	<0.02	66		0.1
Iron	<0.05	41	<0.04	25	<0.05	66		0.2
Lead	<0.01	41	<0.013	25	<0.01	66		0.015
Manganese	<0.02	41	0.54	25	<0.22	66	True	0.05
Silver	<0.001	41	<0.004	25	<0.002	66		0.1
Zinc	<0.02	41	<0.02	25	<0.02	66		0.1

Tailings Impoundment--Post-Closure
Little Cherry Creek Impoundment Area Well Data Used for Existing Conditions

Alternatives 2 & 4
Mass Balance Calculations for ground water below TI

	Existing Ground water Conditions		Expected Tailing Water Input from Seepage		Projected Final Mixing Concen.		Exceedance	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	99	35	200	5	112	40		200
Nitrate	0.1	35	16.1	5	2.1	40		10
Antimony	<0.003	35	0.009	5	<0.004	40		0.006
Cadmium	<0.001	35	0.002	5	<0.001	40		0.005
Copper	<0.01	35	0.035	5	<0.01	40		0.1
Iron	<0.05	35	<0.04	5	<0.05	40		0.2
Lead	<0.01	35	<0.013	5	<0.01	40		0.015
Manganese	<0.03	35	0.54	5	<0.09	40	True	0.05
Silver	<0.001	35	<0.004	5	<0.001	40		0.1
Zinc	<0.02	35	<0.02	5	<0.02	40		0.1

Poorman Impoundment Area Well Data Used for Existing Conditions
Alternative 3
Mass Balance Calculations for ground water below TI

	Existing Ground water Conditions		Expected Tailing Water Input from Seepage		Projected Final Mixing Concen.		Change in concentration	Ground Water Standard or BHES Order Limit
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	(mg/L)	(mg/L)
TDS	102	41	200	5	113	46		200
Nitrate	<0.07	41	16.1	5	<1.8	46		10
Antimony	<0.003	41	0.009	5	<0.004	46		0.006
Cadmium	<0.001	41	0.002	5	<0.001	46		0.005
Copper	<0.01	41	0.035	5	<0.01	46		0.1
Iron	<0.05	41	<0.04	5	<0.05	46		0.2
Lead	<0.01	41	<0.013	5	<0.01	46		0.015
Manganese	<0.02	41	0.54	5	<0.08	46	True	0.05
Silver	<0.001	41	<0.004	5	<0.001	46		0.1
Zinc	<0.02	41	<0.02	5	<0.02	46		0.1

Appendix H—Various Streamflow Analyses

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March 10, 2008

To: Montanore Mine Project EIS

From: Jack Denman, Richard Trenholme, ERO Resources Corporation

Re: **Montanore Tailings Impoundment Watershed Analysis**

This memorandum presents the findings of an analysis of the changes to watershed boundaries resulting from the various tailings impoundment locations for each of the three alternatives (Alternatives 2, 3, and 4) for the Montanore Project. The purpose of the analysis is to assess changes in watershed areas as an indicator of possible streamflow changes.

The primary assumption of this analysis is that watershed area, as a direct measure of catchment area, is directly related to streamflow of the receiving stream in each watershed. Additional assumptions are:

1. Differences in precipitation and runoff due to elevation, soil type, vegetative cover, slope, aspect or other physical, biological, or geologic characteristics of the watershed are negligible across the analysis area. Within the small watersheds of the tailings impoundment sites, differences in elevation are slight.
2. All surface runoff in contact with tailings during operational periods would be intercepted and pumped to the mill for use.
3. The South Saddle Dam and Main Dam (Alternatives 2 and 4) and the Main Dam and Seepage Collection Dam (Alternative 3) would be constructed of tailings, and surface runoff would be pumped to mill.
4. The North Saddle Dam and Diversion Dam (Alternatives 2 and 4) and the Saddle Dam (Alternative 3) would be constructed of local soil and rock, not tailings, and surface runoff would be managed as stormwater and flow into nearby streams.
5. Surface runoff associated with soil stockpiles located across existing watersheds would remain within the respective existing watershed.
6. Surface runoff from the borrow areas outside of the impoundment footprint in Alternatives 2 and 4 would be channeled to Bear Creek during operations and graded to flow into the tailings impoundment upon closure.
7. Seepage collection dams would be removed as part of mine closure.

Watershed Calculations

For the purpose of this analysis, the existing proposed footprints for the three tailings impoundments and associated facilities were plotted over the Hydrographic Unit boundaries. The boundaries were a GIS coverage provided by the Kootenai National Forest (KNF). ERO altered one hydrographic unit, the Libby Creek Upper Tributary, from that provided by the KNF. The altered unit is between Little Cherry Creek and Poorman Creek, and is the unit in which most of the Poorman Tailings Impoundment in Alternative 3 would be located. ERO altered the boundary based on studies of the Diversion Channel and the Poorman Impoundment Site. Kline (2005) reported that the USGS topographic map indicates the diverted stream (between National Forest Service (NFS) roads #6212 and #5181) would flow to the southeast. The field survey revealed that the stream would flow to the northeast and discharge to Libby Creek 1,900 feet downstream of the location indicated on the topographic map. Geomatrix (2006) labeled this stream Channel A. Kline (2005) reported that a closed spur of NFS road #5181 has a culvert to convey the diverted stream and another culvert 1,157 feet to the south. The diverted stream would not naturally flow to the south culvert. According to Kline (2005), it was often difficult to judge where water would flow downgradient of NFS road #5181. Geomatrix (2006) described this south channel as Channel B. In a wetland delineation of the Poorman Impoundment Site, Geomatrix (2007) identified four channels between Little Cherry Creek and Poorman Creek. MMC proposes to divert flows up to about 20 cfs into Channel A, and higher flows into both channels (Geomatrix 2007). Based on these reports and air photo-interpretation, ERO delineated a watershed for Channel A, and a separate watershed for Channel B and the other two channels. The watershed for Channel A is labeled Channel A for this analysis; the watershed for Channel B and the other two channels is labeled Channel BCD.

Each impoundment feature and associated "sub-watershed" was mapped as a polygon using ArcGIS. The mapping enabled an impact area to be calculated for each feature by watershed. For example, precipitation intercepted by the impoundment surface, Main Dam, South Saddle Dam, and Seepage Collection Dam in Alternatives 2 and 4 would be intercepted and sent to the mill. For Alternative 2, this sub-watershed is labeled LCC-2. Likewise, precipitation upstream of the Diversion Dam in Alternative 2 would be diverted into Channel A. This sub-watershed is labeled LCC-5. For purposes of analysis, it was assumed all water upstream of the Diversion Dam in Alternatives 2 and 4 would be diverted into Channel A. This assumption would accurately reflect relative change except during high flow periods, when some flow would flow to Channel B in the Channel BCD watershed. Changes to all watersheds were either added or subtracted from the existing watershed area, depending on whether the change would add watershed area, and therefore "water" to the watershed, or remove it. Total watershed areas were calculated from the location on the receiving stream that would receive diverted "watershed area." As a quality control check, the summation of all diversion areas equal to zero was checked for each scenario to ensure that areas were not counted twice. Finally, percent change in the watershed was calculated for each measurement location of receiving streams to qualitatively estimate potential changes in flow associated with the diversions. Calculations for all

three alternatives were performed, for both operational periods and post-closure based on the general conditions of operation and closure discussed in this memorandum.

Watershed Analysis – Alternative 2

Changes to watershed areas during Alternative 2 operations are shown on Figure 1. Surface runoff from the west face of the Diversion Dam and the Little Cherry Creek watershed upstream of the tailings impoundment (LCC-5) would be diverted to Channel A via the engineered diversion channel. This diversion would become the "new" Little Cherry Creek. The watershed of Channel A would increase during operations from 237 acres to 974 acres. Some high flows would be directed into Channel B. During operations, all surface water in contact with tailings and within the sub-watershed of the Seepage Collection Dam (LCC-2, CHA-2, and BC-1) would be pumped to the mill. These diversions would reduce the watershed of the former Little Cherry Creek from 1,682 acres to 225 acres. The watersheds of two locations in Bear Creek would increase slightly (Table 1). Surface runoff from the borrow area uphill from the tailings impoundment (LCC-4) would be diverted around the Diversion Dam, ultimately into Channel A. Surface runoff from the north face of the North Saddle Dam (LCC-3) would be treated as storm runoff and diverted to Bear Creek.

Alternative 2 post-closure changes to watershed areas are shown on Figure 2. The surface of the tailings impoundment would be graded so that drainage west of the Main Dam crest and north of the South Saddle Dam crest would flow toward Bear Creek. The diversion channel that allowed drainage from the borrow area (LCC-4) would be removed to allow flow into the tailings impoundment and north to Bear Creek with the tailings impoundment surface flow (LCC-6). The watershed area in Bear Creek would increase by 560 acres.

The Seepage Collection Dam would be removed and the former Little Cherry Creek watershed would extend west to the crest of the Main Dam. Runoff east of the Main Dam crest would remain in the former Little Cherry Creek watershed (LCC-8). Similarly, surface runoff upstream of the Diversion Dam face (LCC-7) and south of the South Saddle Dam face (CHA-13) would remain in the Channel A watershed upon closure. After closure, Channel A would have a watershed 678 acres larger than its current 237 acres (Table 1). The Libby Creek watershed at the confluence of Channel A would have a slightly larger watershed (678 acre or 3 percent). Between the confluence of the former Little Cherry Creek and Bear Creek, the Libby Creek watershed would have a slightly smaller watershed (560 acres or 2 percent) compared to existing areas. The Libby Creek watershed above the confluence with Bear Creek, would remain unchanged (Table 1).

Table 1. Changes in Watershed Areas during Operations and Closure, Alternative 2.

	Bear Creek		Former Little Cherry Creek	Channel A	Libby Creek		
Measurement Location	BC-7208	BC-8281	LCC-1682	CHA-A-237	LC-23245	LC-25637	LC-35853
Existing Watershed Area (ac.)	7,208	8,281	1,682	237	23,245	25,637	35,853
Operations							
Change in Watershed (ac.)	8	2	-1,457	737	737	-720	-720
New Watershed Area (ac.)	7,217	8,283	225	974	23,982	24,917	35,135
% Change	<1%	<1%	-87%	311%	3%	-3%	-2%
Closure							
Change in Watershed (ac.)	560	560	-1,238	678	678	-560	0
New Watershed Area (ac.)	7,768	8,841	445	915	23,923	25,077	35,853
% Change	8%	7%	-74%	286%	3%	-2%	0%

Watershed Analysis – Alternative 3

Alternative 3 operational changes to the existing watersheds are shown in Figure 3. During operations, surface runoff in contact with tailings and the Main Dam face, and within the Seepage Collection Dam sub-watershed (CHA-4, CHBD-1, LC-3, LC-4, LCC-9, LCC-10, and LCC-11), would be diverted to the mill. Surface runoff from the Saddle Dam face (CHA-5) would be diverted to Little Cherry Creek. Surface runoff from the western watershed boundary of Channels BCD to the western extent of tailings (CHA-6, CHBD-2, and CHBD-3) would be diverted based on a topographic divide between Channels C and D, with runoff from the northern sub-watershed (CHA-6 and CHBD-3) diverted to Little Cherry Creek; and runoff from the southern sub-watershed (CHBD-2) diverted to Poorman Creek. Runoff from the southern portion of the Channel BCD watershed (CHBD-4) would be diverted to Libby Creek because of topographic isolation from the remaining Channel BCD watershed by the Main Dam. These diversions would reduce the watershed of Channel BCD from 759 acres to 117 acres. The watersheds of Poorman Creek and Little Cherry Creek would increase during operation by 146 and 79 acres, respectively (Table 2). The Libby Creek watershed between Poorman Creek and Channels BCD would increase slightly (166 acres or 1 percent), and decrease slightly between Channels BCD and the confluence of Channel A and Libby Creek (690 acres or 3 percent).

Alternative 3 post-closure changes to existing watersheds are shown on Figure 4. After closure, the surface of the tailings impoundment would be graded to allow surface runoff from the impoundment to flow toward Little Cherry Creek. A portion of the northern face of the Main Dam (CHA-11) would flow into the Little Cherry Creek drainage because of the elevation of the final dam face. The drainage channel that allowed surface runoff from the western portion of the Channel BCD watershed to flow to Poorman Creek (during operations) would be removed and graded to allow all surface drainage to flow toward Little Cherry Creek (CHBD-6, CHBD-8, and CHA-

8). These changes would increase the watershed of Little Cherry Creek from 1,457 to 2,101 acres. The Poorman Creek watershed would remain unchanged at closure, compared to the pre-operation size of the watershed.

Surface runoff from the face of the Main Dam would remain in the respective watersheds of final construction (sub-watersheds CHA-7, CHBD-5, CHBD-7, LCC-9, LCC-10 and LC-3). The Seepage Collection Dam would be removed prior to closure (LC-3). Surface runoff from the south face of the Main Dam (CHBD-7) and the southern extent of the Channel BCD watershed (CHBD-4) would flow to Libby Creek because of the topographic isolation described above during operations. The Libby Creek watershed above the confluence with Little Cherry Creek, would remain unchanged (Table 2).

Table 2. Changes in Watershed Areas during Operations and Closure, Alternative 3.

	Poorman Creek	Little Cherry Creek		Channel A	Channel BCD	Libby Creek		
Measurement Location	PC-3651	LCC-940	LCC-1457	CHA-A-247	CHA-BCD-759	LC-21482	LC-23245	LC-25637
Existing Watershed Area (ac.)	3,651	940	1,457	247	759	21,482	23,245	25,637
Operations								
Change in Watershed (ac.)	146	77	79	-204	-642	166	-690	-611
New Watershed Area (ac.)	3,797	1,017	1,536	43	117	21,648	22,555	25,026
% Change	4%	8%	5%	-83%	-85%	1%	-3%	-2%
Closure								
Change in Watershed (ac.)	0	633	644	-157	-546	60	-644	0
New Watershed Area (ac.)	3,651	1,573	2,101	90	213	21,542	22,601	25,637
% Change	<1%	67%	44%	-64%	-72%	<1%	-3%	0%

Watershed Analysis – Alternative 4

Alternative 4 operational changes to existing watersheds are shown in Figure 5. Surface water drainage during operations is similar to Alternative 2, with all surface runoff in contact with tailings to be pumped to the mill (LCC-14, CHA-2, and BC-1). Surface runoff from the North Saddle Dam face (LCC-3) would flow to Bear Creek. The watershed of Bear Creek would increase by about 2 to 8 acres (Table 3). A diversion ditch at the base of the borrow area (LCC-15) would divert surface runoff as stormwater to the diversion dam. Surface runoff from the Little Cherry Creek watershed above the Diversion Dam (LCC-13) and the soil borrow area (LCC-15) would be conveyed to Channel A. Tailings runoff diversion to the mill and Channel A diversions would reduce the watershed of Little Cherry Creek by 1,457 acres and increase the watershed of Channel A by 737 acres.

Alternative 4 changes to existing watersheds after closure are shown in Figure 6. The primary difference between Alternatives 2 and 4 is in closure. In Alternative 4, the Tailings Impoundment would be sloped to allow drainage to the southwest, around the Diversion Dam. The diversion ditch at the base of the borrow area would allow flow

to the Tailings Impoundment and subsequently to Channel A. Flows from the Tailings Impoundment (LCC-15 and LCC-16), and from the Little Cherry Creek watershed above the Diversion Dam (LCC-18), would be diverted to Channel A. The Seepage Collection Dam would be removed prior to closure. Surface flow from the dam faces would flow downhill to the receiving watershed, post-closure. These changes would decrease the watershed of Little Cherry Creek by 1,242 acres. The Channel A watershed would increase by 1,234 acres. The Libby Creek watershed, above the confluence with Bear Creek, would remain unchanged (Table 3).

Table 3. Changes in Watershed Areas during Operations and Closure, Alternative 4.

	Bear Creek		**Little Cherry Creek**		**Channel A**	**Libby Creek**		
Measurement Location	BC-7208	BC-8281	LCC-1457	LCC-1682	CHA-A-237	LC-23245	LC-25637	LC-35,853
Existing Watershed Area (ac.)	7,208	8,281	1,457	1,682	237	23,245	25,637	35,853
Operations								
Change in Watershed (ac.)	8	2	-1,457	-1,457	737	737	-720	-720
New Watershed Area (ac.)	7,216	8,283	0	225	974	23,982	25,242	35,102
% Change	<1%	<1%	-100%	-87%	311%	3%	-3%	-2%
Closure								
Change in Watershed (ac.)	8	8	-1,242	-1,242	1,234	1,234	-8	0
New Watershed Area (ac.)	7,216	8,289	215	440	1,470	24,478	25,629	35,853
% Change	<1%	<1%	-85%	-74%	520%	5%	<1%	0%

References

Geomatrix Consultants, Inc. 2006. Analysis of conceptual tailings impoundment diversion drainage alternatives, Montanore Mine Project. Submitted to the KNF and the DEQ. p. 41 plus appendices.

Geomatrix Consultants, Inc. 2007. Survey of wetlands, sensitive plants, and amphibian/reptiles in alternative sites for tailings impoundment, plant facility and mine tunnel, Montanore Mine Project. Prepared for Montanore Minerals Corp. p. 15 plus appendices.

Kline Environmental Research, LLC. 2005. Montanore Project: Fish habitat potential in the Little Cherry Creek tailings impoundment diversion. Submitted to the KNF and the DEQ. p. 20 plus appendices.

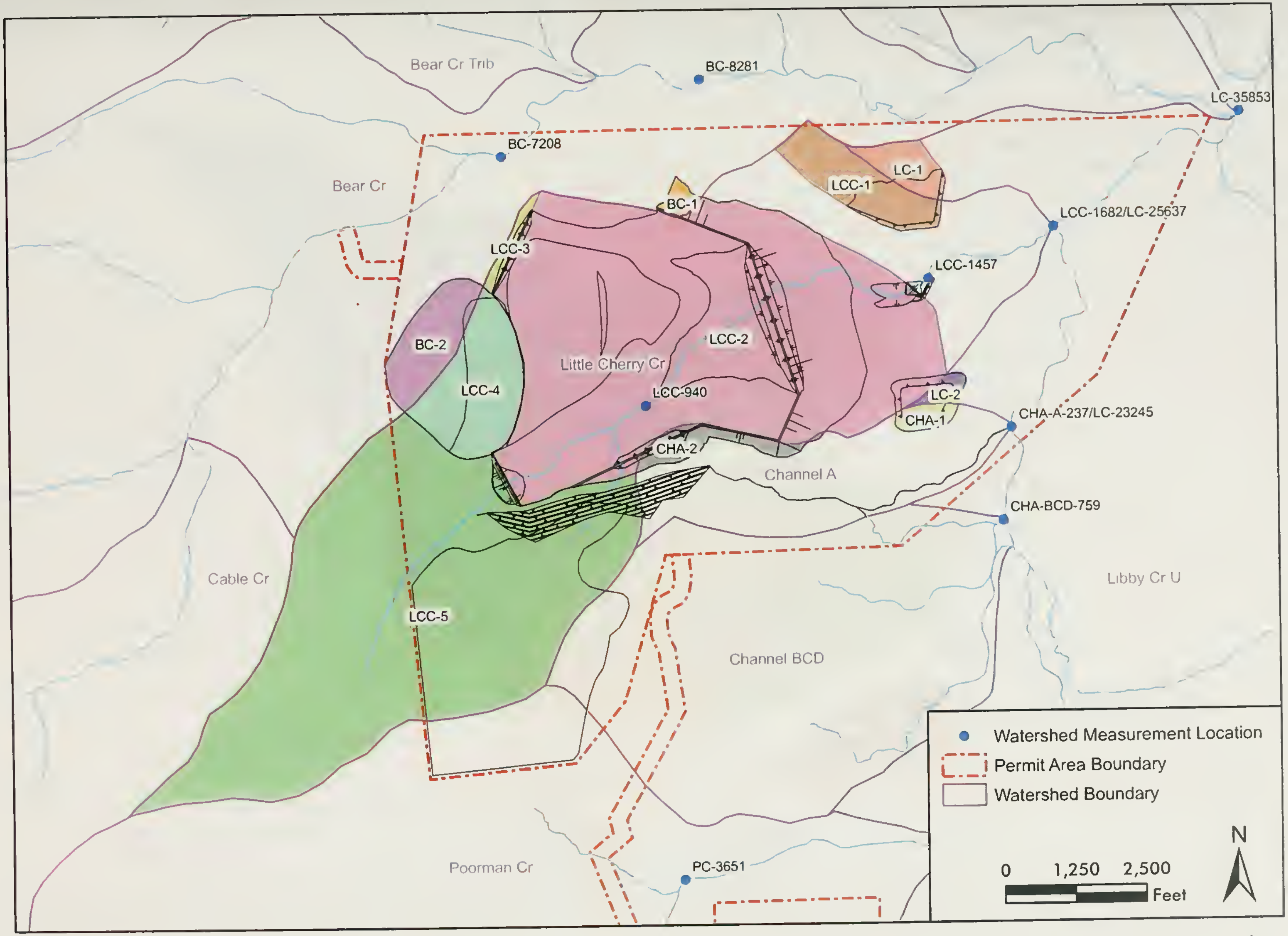

Figure 1. Watershed Analysis, Alternative 2 Operations

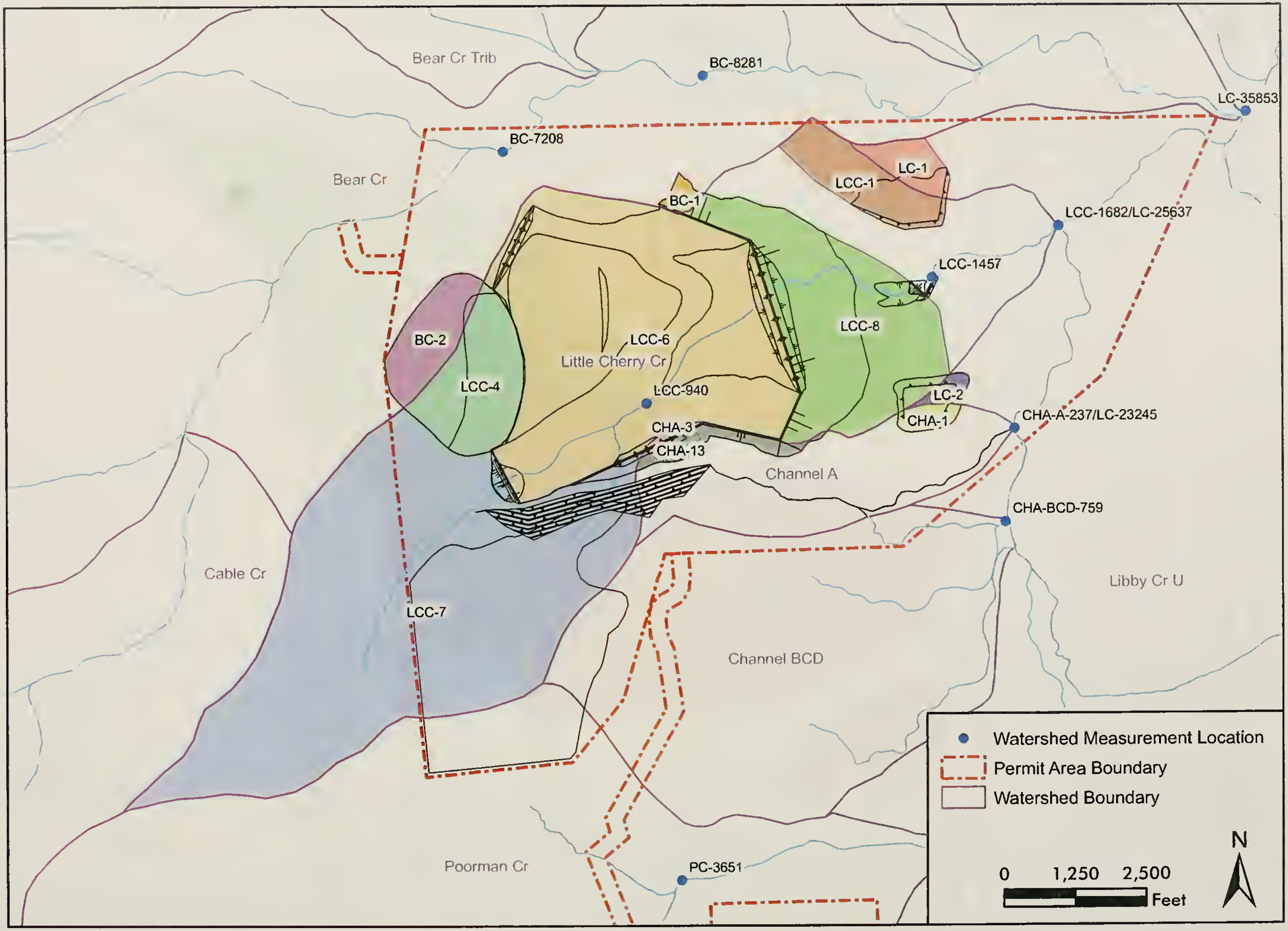

Figure 2. Watershed Analysis, Alternative 2 Closure

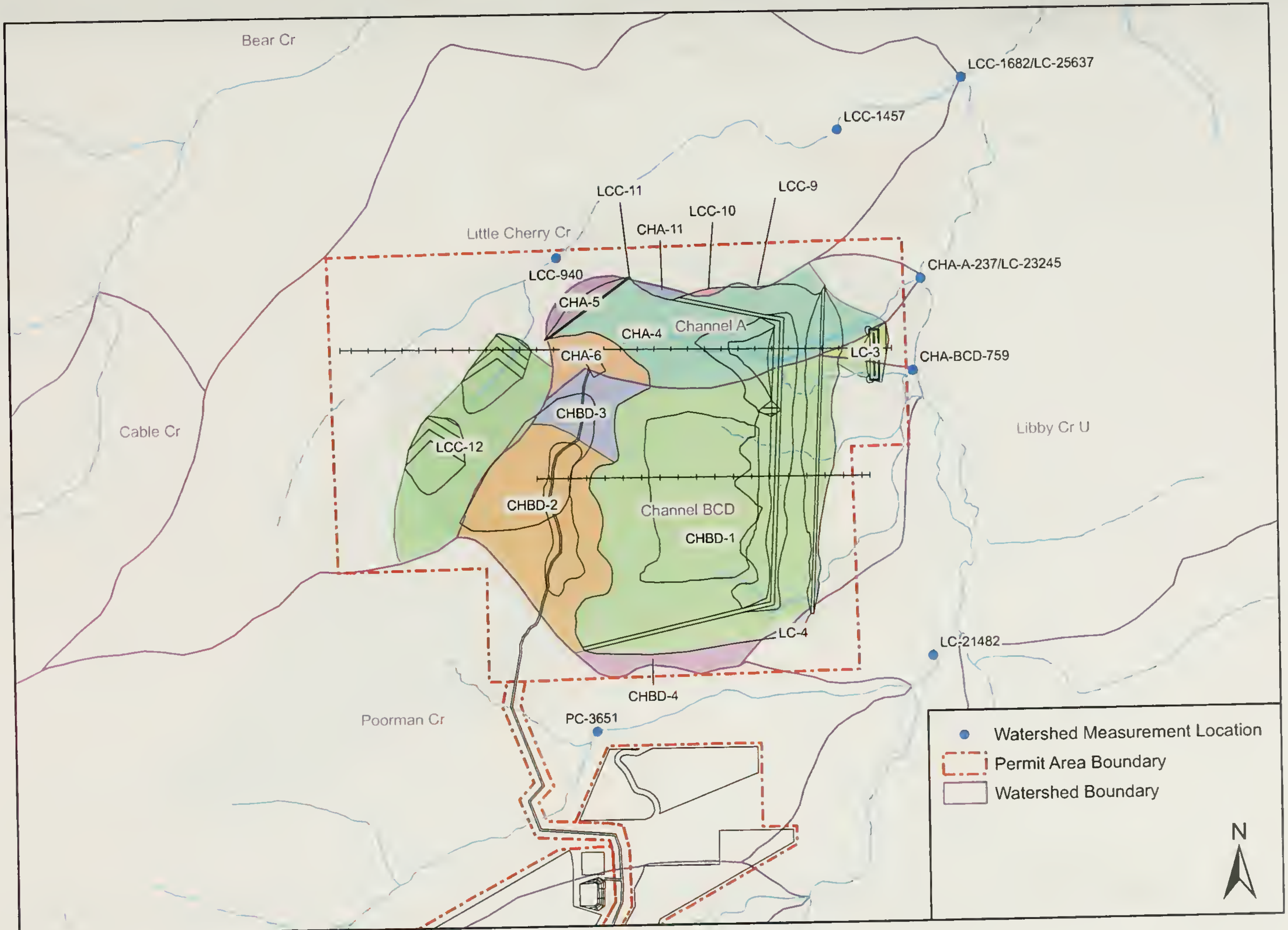

Figure 3. Watershed Analysis, Alternative 3 Operations

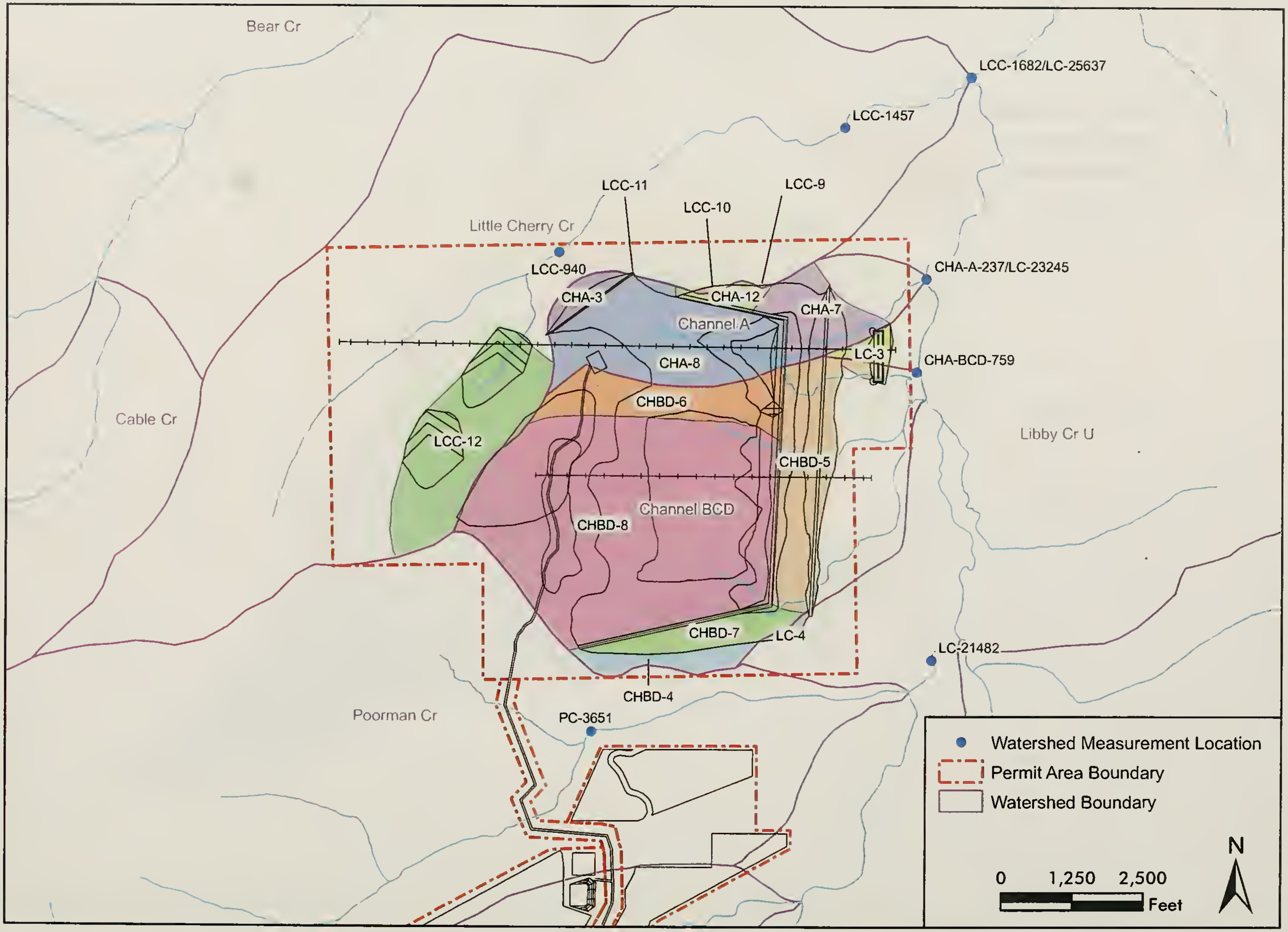

Figure 4. Watershed Analysis, Alternative 3 Closure

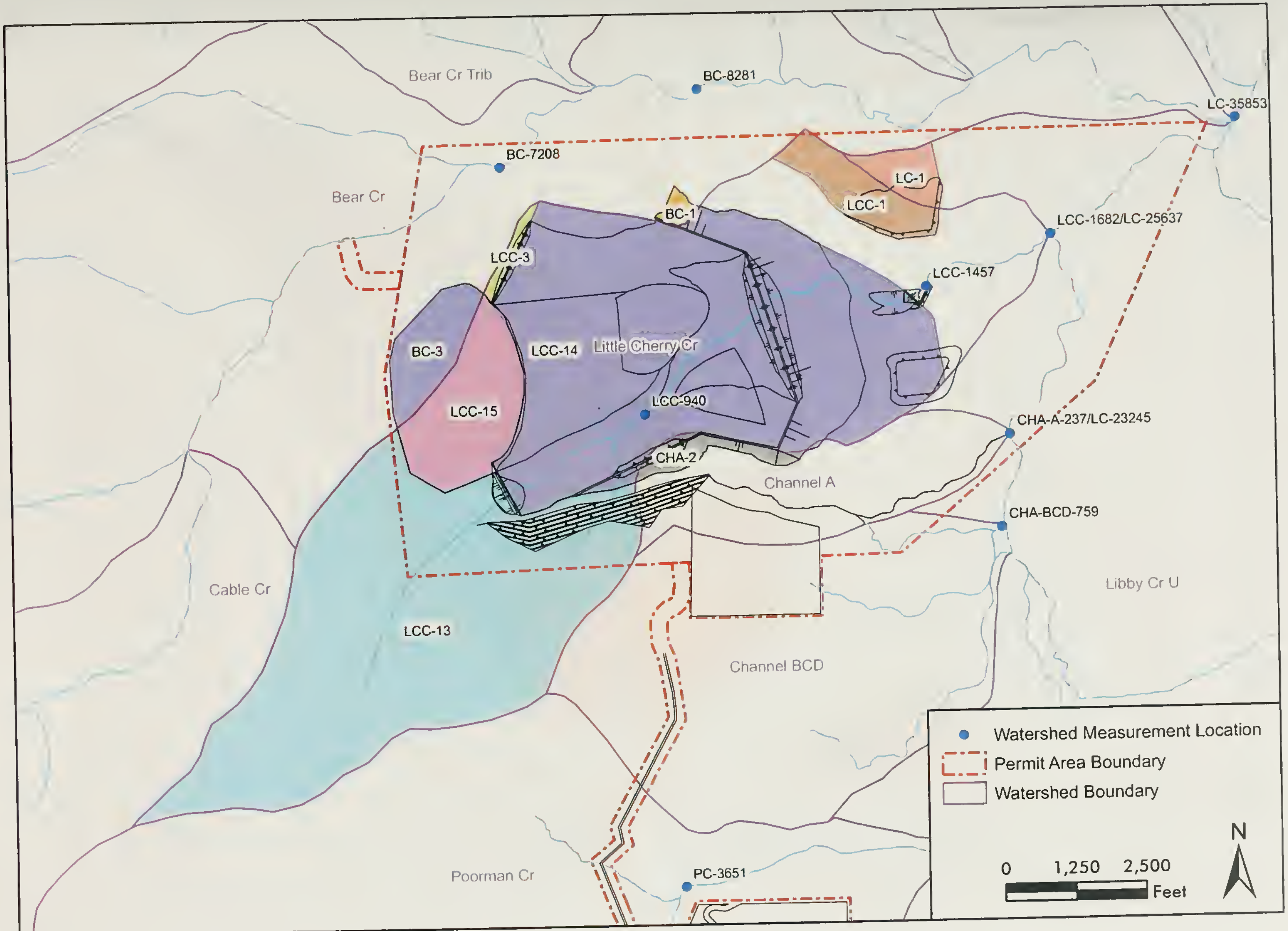

Figure 5. Watershed Analysis, Alternative 4 Operations

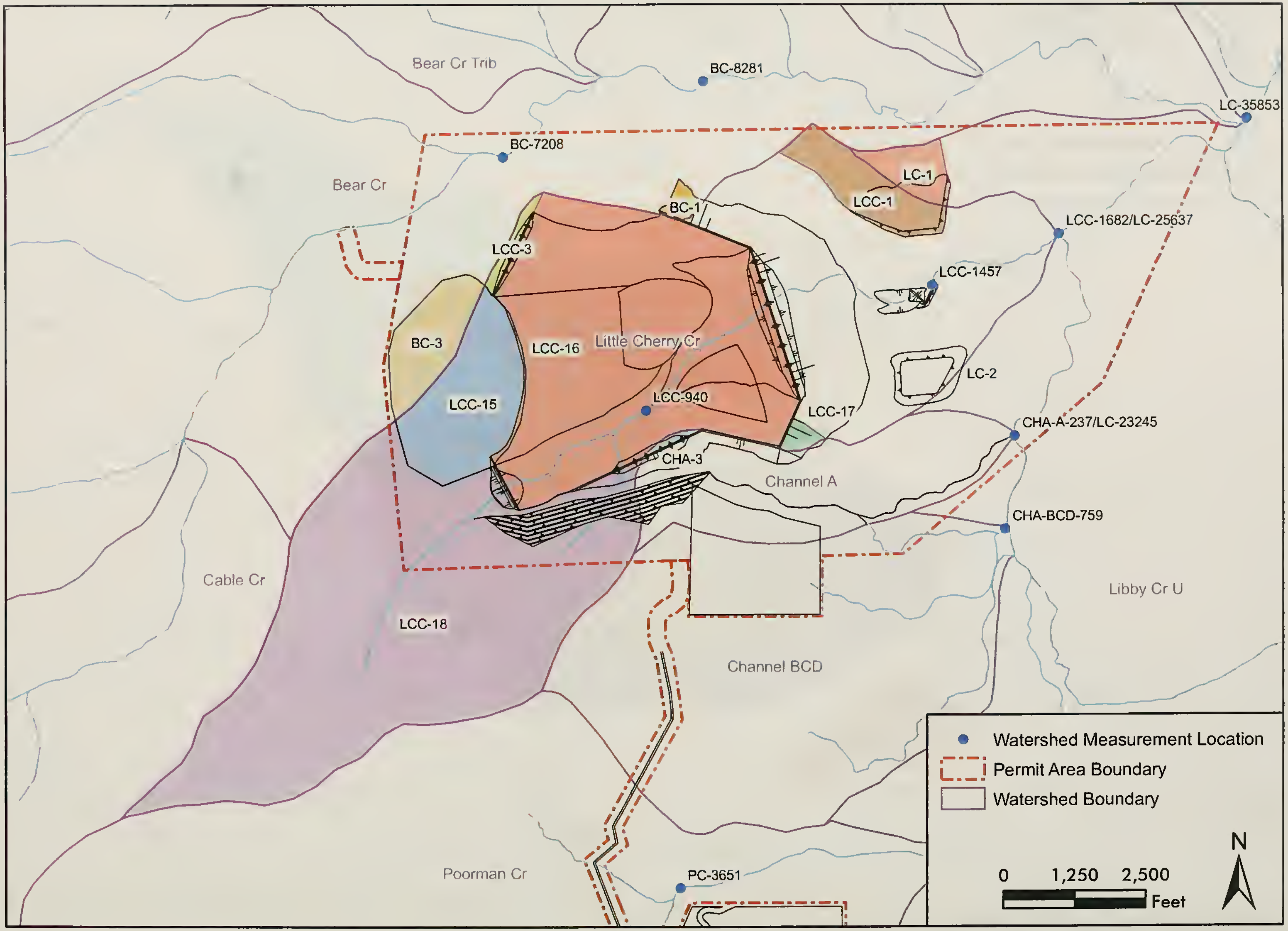

Figure 6. Watershed Analysis, Alternative 4 Closure

Water Yield Discussion for Montanore Mine Alternatives and Transmission Line Alternatives

The Kootenai National Forest Plan contains water yield guidelines based on instream resource values (Guidelines for Calculating Water Yield Increases, Appendix 18, KNF Plan). Because the greatest risk of degrading channel function occurs during high flow periods, it is the increase in magnitude and duration of peakflows that concerns land managers the most. Timber harvest often alters normal streamflow dynamics, particularly the volume of peak flows (maximum volume of water in the stream) and base flows (the volume of water in the stream representing the groundwater contribution). The degree these parameters change depend on the road density, percentage of total tree cover removed from the watershed, and the amount of soil disturbance caused by the harvest, among other things. For example, if harvest activities remove a high percentage of tree cover and cause light soil disturbance and compaction, rain falling on the soil will infiltrate normally. However, due to the loss of tree cover, evapotranspiration (the loss of water by plants to the atmosphere) will be much lower than before. Thus, the combination of normal water infiltration into the soil and decreased uptake of water by tree cover results in higher stream flows. In general, timber harvest on a watershed scale results in water moving more quickly through the watershed (i.e. higher runoff rates, higher peak and base flows) because of decreased soil infiltration and evapotranspiration. The creation of openings in a forested canopy would tend to increase snow deposition (Christner and Harr 1982) and wind speeds (Chamberlin 1982). An increase in wind speeds could increase the rate of snowmelt during cloudy and rainy conditions resulting in greater streamflow (Harr 1981).

Water yield increases due to timber harvest activities are a function of canopy reduction and miles of road constructed. Hydrologic responses to these activities will depend on the natural characteristics of the watershed. They can include: increases in snowpack depth, melting rates, surface runoff, subsurface flow interception and landform energy aspects. As discussed under the streamflow regime section, Rain-on-snow (ROS) events can occur in the project area drainages. Water yield estimates for the project area were determined using the KNF beta version of the Equivalent Clearcut Acres Calculator (ECAC). This process is a GIS interface with management activity databases (Oracle and TSMRS) that allows watershed specialists to model (estimate) the current equivalent clearcut acres (ECA) within a watershed of interest. The model calculates disturbances based on the "ECA" (Equivalent Clearcut Acre) procedure. For example a 100-acre harvest area with 100 percent canopy removal would equate to 100 ECAs; a 100-acre harvest with a 52% crown removal would equate to 44 ECAs. The ECAC model calculates ECA for a specified watershed based on the most recent and most impactive (greatest crown removal) management activities associated with roads, timber harvest, and land conversion. The ECAC model does not model peak flows or sediment production and transport. Watershed specialists must use additional models, indices, measures, monitoring, site-specific data, and professional experience to analyze cumulative watershed effects.

The ECAC Model was not designed to develop estimates of flow. The development of flow estimates from ECAC output generally involves separating watersheds by size class and precipitation regime that had already been run through the R1-WATSED model and comparing their results with the above mentioned ECAC process to look at water yield estimates. This procedure has allowed a more simplified analysis path based on ECAs to generate water yield estimates that have been validated by comparison with the R1-WATSED model output. Regression lines created from R1-WATSED outputs are used to determine the number of ECAs

required to generate a 1% increase in peak flows and also the number of ECAs that recover each year in a watershed. Copies of the regression graphs are included in the project file.

The ECAC Model was designed as a quick-analysis tool to enable watershed professionals to estimate the potential effects of forest management (harvest and roading). The utility of the Model is that it offers a quick and consistent method of providing information on past and proposed management activities. The values generated by the model are used, in concert with other water resource information, to interpret the potential effects to a stream channel as a result of implementing a proposed land management activity. Values generated by the model are not to be considered as an absolute measure against verifiable standards, nor by themselves provide an answer as to the effects of implementing the proposed land management activity. Please see Appendix 8 for a more detailed discussion of the models used in this analysis.

Data for the proposed Montanore Mine build out options and the various transmission line options have been run through the ECAC process and the results are displayed below in Tables H- through 4. In general, none of the transmission line options will result in a measurable increase in peak flows to any of the watersheds. For the mine facilities build out options, (besides Little Cherry Creek – see discussion below) only alternative 2 in the Ramsey Creek watershed approaches an increase in water yield that could be measurable compared to existing conditions. On a cumulative basis, the projected increases in Ramsey and Poorman Creek will also be approaching a measurable level for water yields.

The projected impacts to water yield in Little Cherry Creek are for the unaltered basin. Because the alternatives include the construction of a tailings impoundment in the watershed, the majority of the watershed will captured within the tailings impoundment and the water would used in the milling process for the mine. For this reason, the values shown in Tables 1 and 2 for Little Cherry Creek do not represent what that actual condition would be on the ground. It is assumed that the constructed by-pass stream channel which drains the upper portion of the Little Cherry Creek watershed (which is not impacted by the proposal) will be sized correctly to remain in a stable, functional condition.

Depending on which mine build out option is chosen and which transmission line route option is chosen for the preferred alternative, the total cumulative impact to water yield will need to be added from Tables H-2 and H-3 for the selected watersheds. A review of the potential options shows that the combination of Alternative 2 for mine build out and Alternative B for transmission line route would have the highest probability of resulting in a measurable impact to Ramsey Creek. Not withstanding the previous discussion about impacts to Little Cherry Creek, the remaining options for mine build out and transmission line routes all fall within an acceptable level of cumulative impact to water yields for all reviewed watersheds. As mentioned previously, the cumulative level of water yield will be approaching measurable levels in Ramsey and Poorman Creek but none of the transmission line options access the Poorman drainage so the impacts would not be greater than those displayed in Tables H-1 and H-2.

References

Chamberlin, T.W. 1982. Timber Harvest. In: Meehan, W.R., tech, ed., Influence of Forest and Rangeland Management on Anadromous Fish Habitat in Western North America. USDA, Forest Service, PNFRES, General Technical Report- 136, April.

Christner, J., and R.D. Harr. 1982. Peak Streamflows from the Transient Snow Zone, Western Cascades, Oregon. In: Proceedings of the Western Snow Conference, Reno, Nevada, April 19-23, 1982. Colorado State University, Fort Collins, Colorado.

Harr, R.D. 1981. Some characteristics and consequences of snowmelt during rainfall in western Oregon. J. Hydrol., 53:.277-304

Table H-1. Projected Water Yield Increase by Alternative for Full Mine Operation.

Drainage	Existing		Alt 2		Alt 3		Alt 4	
	ECAs	PFI	ECAs	PFI	ECAs	PFI	ECAs	PFI
Bear	610	4.1	172	1.1	18	0.1	169	1.1
Big Cherry	5,145	3.0	58	.03	58	.03	58	.03
Getner	347	13.3	3	0.1	3	0.1	3	0.1
Little Cherry	387	32.2	1,252	104	328	27.3	1,069	89.1
Poorman	216	5.4	214	5.3	182	4.6	132	3.3
Ramsey	166	3.6	373	8.1	274	5.9	274	5.9
Rock	1,376	3.0	1	0.0	1	0.0	1	0.0
Upper Libby†	4,038	3.2	2,014	1.6	805	0.6	1,647	1.3
Libby Total	17,952	3.5	2,072	0.4	863	0.2	1,705	0.3

Note: These values do not include the various transmission line alternatives.
†The Upper Libby Creek watershed outlet is the bridge where it is crossed by U.S. 2.

Table H-2. Projected Cumulative Water Yield Increase by Alternative for Full Mine Operation.

Drainage	Alt 2		Alt 3		Alt 4	
	ECAs	PFI	ECAs	PFI	ECAs	PFI
Bear	782	5.2	628	4.2	779	5.2
Big Cherry	5,203	3.0	5,203	3.0	5,203	3.0
Getner	350	13.4	350	13.4	350	13.4
Little Cherry‡	1,639	136.2	715	59.5	1,456	121.3
Poorman	430	10.7	398	10.0	348	8.7
Ramsey	539	11.7	440	9.5	440	9.5
Rock	1,377	3.0	1,377	3.0	1,377	3.0
Upper Libby†	6,052	4.8	4,843	3.8	5,685	4.5
Libby Total	20,024	3.9	18,815	3.7	19,657	3.8

Note: These values do not include the various transmission line alternatives.
†The Upper Libby Creek watershed outlet is the bridge where it is crossed by U.S. 2.
‡In all alternatives the majority of the disturbance acres in the Little Cherry Creek watershed would be altered for the construction of the tailings impoundment. These acres would not discharge water to the lower section of Little Cherry Creek. This will result in a much lower PFI (similar to existing) to the lower section of Little Cherry Creek than what is displayed.

Table H-3. Projected Water Yield Increase by Alternative for Transmission Line Construction.

Drainage	Existing		Alt B		Alt C		Alt D		Alt E	
	ECAs	PFI	ECAs	PFI	ECAs	PFI	ECAs	PFI	ECAs	PFI
Howard	117	8.4	16	1.1	20	1.4	59	4.2	59	4.2
Ramsey	166	3.6	24	0.5	0	0	0	0	0	0
Midas	535	13.4	36	0.9	40	1.0	0	0	0	0
Miller	1,253	7.4	104	0.6	135	0.8	141	0.8	9	0.05
Fisher Tribs‡	n/a	n/a	89	n/a	120	n/a	120	n/a	84	n/a
West Fisher	2,160	3.1	0	0	0	0	13	.02	193	0.3
Upper Libby†	4,038	3.2	87	.07	69	.05	69	.05	69	.05
Fisher Total	53,133	4.1	193	.01	255	.02	274	.02	286	.02

‡Fisher River tributaries include Hunter, Sedlak and a face drainage. These areas do not have stream channels with direct connections to the Fisher River. These areas were all combined in the Fisher Total value.

†The Upper Libby Creek watershed outlet is the bridge where it is crossed by U.S. 2.

Table H-4. Projected Cumulative Water Yield Increase by Alternative for Transmission Line Construction.

Drainage	Alt B		Alt C		Alt D		Alt E	
	ECAs	PFI	ECAs	PFI	ECAs	PFI	ECAs	PFI
Howard	133	9.5	137	9.8	293	12.6	293	12.6
Ramsey	190	4.1	166	3.6	166	3.6	166	3.6
Midas	571	14.3	575	14.4	535	13.4	535	13.4
Miller	1,357	8.0	1,388	8.2	1,394	8.2	1,262	7.4
West Fisher	2,160	3.1	2,160	3.1	2,173	3.1	2,353	3.4
Upper Libby†	4,125	3.3	4,107	3.3	4,107	3.3	4,107	3.3
Fisher Total	53,326	4.1	53,388	4.1	53,407	4.1	53,419	4.1

†The Upper Libby Creek watershed outlet is the bridge where it is crossed by U.S. 2.

Appendix I—Visual Simulations

Figure I-1. Visual Simulation of the Little Cherry Creek Impoundment Looking West from the Scenic Overlook on NFS Road #4776

Figure I-2. Visual Simulation of the Poorman Impoundment Looking West from the Scenic Overlook on NFS Road #4776

Figure I-3. Visual Simulation of the Miller Creek or West Fisher Creek Transmission Line Alignments Looking Southeast from Howard Lake

Appendix J— Montanore 230-kV Transmission Line Minimal Impact Standard Assessment

Appendix J
Montanore 230-kV Transmission Line Minimal Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C		Altternative D		Alternative E		Alternatives C, D and E	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
Circular MFSA-2, section 3.2(d)(1)(d)(i) through (xi)														
i. National wilderness areas	N/A	N/A	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	none	No direct effect on wilderness attributes	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	none	No direct effect on wilderness attributes
ii. National primitive areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
iii. National wildlife refuges and ranges	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
iv. State wildlife management areas and wildlife habitat protection areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
v. National parks and monuments	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
vi. State parks	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
vii. National recreation areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
viii. Designated or eligible national wild and scenic rivers system	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
ix. Roadless areas over 5,000 acres	acres in clearing width/ low, moderate, high effect	Miles of new and high upgrade roads	2, moderate effect	0.1	none	moderate effect	No effect	No effect	No effect	No effect	No effect	No effect	Avoidance of IRAs	No effect
x. Rugged topography (areas with slopes >30%)	miles of centerline/ low, moderate, high effect	Acres/ low, moderate, high effect	7.4	16.5	none	moderate effect	5.2	2.1	2.9	1.3	3.4	2.1	Helicopter use for vegetation clearing and structure construction adjacent to grizzly bear core habitat to decrease number of access roads	Minor effect
xi. Specially managed buffer areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
Circular MFSA-2, section 3.4(1)(b) through (w)														
b. state or federal waterfowl production areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
c. Designated natural areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect

Appendix J
Montanore 230-kV Transmission Line Minimal Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C		Altternative D		Alternative E		Alternatives C, D and E	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
d. Critical habitat for federal T&E species														
Bull trout	# structures within 1 mile of bull trout critical habitat	acres new and high-upgrade road disturbance within 1 mile of bull trout critical habitat	15	3.5	Implementation of Storm Water Pollution Prevention Plan and structural and nonstructural BMPs. Construction of stream crossings per KNF and DEQ requirements; minimization of disturbance on active floodplains; curtailement of construction activities during heavy rains. Additional measures described under "severe erosion risk" below.	May affect, and likely to adversely affect bull trout critical habitat.	9	0.6	6	0.6	28	1.7	In addition to measures described for Alternative B: re-routing to avoid highly erosive soils; use of H-frame poles, allowing longer spans and fewer structures and access roads; helicopter construction in grizzly bear core habitat to decrease number of access roads; placement of NFS road #4725 into long-term intermittent stored status; where feasible, location of structures outside of riparian areas; new culverts to allow fish passage; stream-crossing structures designed to withstand a 100-year flow event; completion of habitat inventory and development of instream structures in Libby Creek. Additional measures described under "severe erosion risk" below.	May affect, and likely to adversely affect bull trout critical habitat.
e. Seasonally occupied habitat for federal and state T&E species														
grizzly bear habitat physically removed	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	32	N/A	Protection of grizzly bear habitat through acquisition of or conservation easements on 2,826 acres of non-Forest System lands. Closure of NFS road #4724 from April 1 to June 30.	May affect, and likely to adversely affect grizzly bear	11	N/A	12	N/A	13	N/A	Protection of grizzly bear habitat through acquisition of or conservation easements on 24 to 28 acres of habitat on non-Forest System lands. Habitat enhancement for temporary displacement effects. Creation of grizzly bear core habitat through yearlong access changes through the installation of barriers or gates in several roads.	May affect, and likely to adversely affect grizzly bear
Temporary displacement effects on grizzly bears due to helicopter use	acres in influence zone	N/A - all roads included in heli. const. influence zone	14,901	N/A	Same as above	May affect, and likely to adversely affect grizzly bear	12,582	N/A	13,586	N/A	16,501	N/A	Same as above	May affect, and likely to adversely affect grizzly bear
clearing of lynx overall habitat	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	117	N/A	Potential benefits to lynx from land acquisitions for grizzly bear and big game mitigation.	May affect, and likely to adversely affect Canada lynx	79	N/A	108	N/A	193	N/A	Potential benefits to lynx from land acquisitions for grizzly bear and big game mitigation.	May affect, and likely to adversely affect Canada lynx
clearing of lynx denning habitat	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	31	N/A	Potential benefits to lynx from land acquisitions for grizzly bear and big game mitigation.	May affect, and likely to adversely affect Canada lynx	19	N/A	19	N/A	24	N/A	Potential benefits to lynx from land acquisitions for grizzly bear and big game mitigation.	May affect, and likely to adversely affect Canada lynx
occupied bull trout habitat	acres in clearing width and width of new and high-upgrade roads in watersheds with occupied bull trout habitat	Included in clearing width impacts	181	N/A	Same as bull trout critical habitat above.	May affect, and likely to adversely affect bull trout	111	N/A	84	N/A	179	N/A	Same as bull trout critical habitat above.	May affect, and likely to adversely affect bull trout
f. National historic landmarks, districts, or sites	# of sites	Included in transmission line analysis buffer	0	N/A	N/A	No effect	0	N/A	0	N/A	0	N/A	N/A	No effect

Appendix J
Montanore 230-kV Transmission Line Minimal Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C		Allternative D		Alternative E		Alternatives C, D and E	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
g. Eligible historic landmarks, districts, or sites	# of sites	Included in transmission line analysis buffer	4	N/A	Review and consultation with the SHPO to receive consensus determinations and to develop a plan of action for site 24LN1818. Additional fieldwork may be necessary prior to SHPO consultation.	Because there would be no direct effects, a determination of no adverse effect may be achieved through SHPO consultation.	3	N/A	3	N/A	3	N/A	Review and consultation with the SHPO to receive consensus determinations and to develop a plan of action for site 24LN1818. Additional fieldwork may be necessary prior to SHPO consultation.	Because there would be no direct effects, a determination of no adverse effect may be achieved through SHPO consultation.
h. Municipal watersheds	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
i. FWP Class I or II streams or rivers	acres in clearing width within watershed of affected streams	Acres of roads within watershed of affected streams	106.9	7	Same as described above for "occupied bull trout habitat" and below for "severe erosion risk".	Minor increases in sediment	72.2	0.3	46.7	0.3	46.7	0.3	Same as described above for "occupied bull trout habitat" and below for "severe erosion risk".	Minor effects
j. 303(d) listed impaired streams	acres in clearing width within watershed of affected streams	Acres of roads within watershed of affected streams	94.7	3.5	Same as described above for "occupied bull trout habitat"and below for "severe erosion risk".	Minor increases in sediment	67.5	0.6	67.8	0.6	29.1	0.3	Same as described above for "occupied bull trout habitat"and below for "severe erosion risk".	Minor effects
k. Highly erodible soils/reclamation constraints														
Severe erosion risk	miles of centerline	Acres of roads	6.7	8.9	Erosion and sediment control BMPs; interim reclamation (replacing soil where it was removed and reseeding) of access roads ; immediate stabilization of cut-and-fill slopes; seeding, application of fertilizer, and stabilization of road cut-and-fill slopes and other disturbances along roads as soon as final grades post-construction grades are achieved; at the end of operations, decommissioning of new roads and reclamation of most other currently existing roads to pre-operational conditions; ripping of compacted soils prior to soil placement, and disking and harrowing of seedbeds.	Minor losses of soil until re-establishment of vegetation.	3.7	4.2	5.2	4.2	3.7	3.1	In addition to measures described for Alternative B: development and implementation of a Road Management Plan; where feasible, soil salvage in 2 lifts; after removal of transmission line, soil salvage before reclamation of decomissioned roads. Additional measures described above for "bull trout occupied habitat".	Minor losses of soil until re-establishment of vegetation.
High sediment delivery	miles of centerline	Acres of roads	5.1	6.3	Same as for erosion risk above	Minor contributions of sediment until re-establishment of vegetation	1.1	1.5	1.1	1.5	0.4	0.5	Same as for erosion risk above	Minor contributions of sediment until re-establishment of vegetation
l. Compatibility with visual management plans/regulations														
Compatibility with visual management plans	Yes/No	Yes/No	Yes	Yes	Forest Plan amendment	In compliance	Yes	Yes	Yes	Yes	Yes	Yes	Forest Plan amendment	In compliance
Indirect visual impacts to the CMW	Acres within CWA from which transmission line can be seen	N/A	1,501	N/A	none	No effect on wilderness attributes	1,426	N/A	1,,233	N/A	1,177	N/A	none	No effect on wilderness attributes

Appendix J
Montanore 230-kV Transmission Line Minimal Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C		Altternative D		Alternative E		Alternatives C, D and E	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
m. Winter habitat for elk, deer, moose, pronghorn, or bighorn sheep														
elk	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	123	N/A	Potential benefits to elk from land acquisitions and road access changes for grizzly bear and big game mitigation. As described in the Environmental Specifications, transmission line construction and associated motorized travel would be prohibited from December 1 to April 30. Exemptions to these timing restrictions may be granted by DEQ and FS in writing if MMC can clearly demonstrate that no significant environmental impacts will occur as a result.	Minor effects	174	N/A	149	N/A	93	N/A	Potential benefits to elk from land acquisitions and road access changes for grizzly bear and big game mitigation. As described in the Environmental Specifications, transmission line construction and associated motorized travel would be prohibited from December 1 to April 30. Exemptions to these timing restrictions may be granted by DEQ and FS in writing if MMC can clearly demonstrate that no significant environmental impacts will occur as a result.	Minor effects
white-tailed deer	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	149	N/A	Same as described above for elk	Minor effects	191	N/A	208	N/A	179	N/A	Same as described above for elk	Minor effects
moose	acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	146	N/A	Same as described above for elk	Minor effects	165	N/A	168	N/A	210	N/A	Same as described above for elk	Minor effects
n. Elk security areas	Acres of security habitat in clearing width	Included in clearing width impacts	84	N/A	Security habitat maybe created through additional road access changes that may occur on land acquired as part of the grizzly bear mitigation.	Minor effects	48.7	N/A	No effect	N/A	No effect	N/A	Creation of security habitat through yearlong access changes through the installation of barriers or gates in several National Forest System roads. Additional security habitat may also be created through additional road access changes that may occur on land acquired as part of the grizzly bear mitigation.	Minor effects
o. Occupied mountain goat habitat														
habitat physically impacted	acres in clearing width	Included in clearing width impacts	47	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear and big game mitigation.	Minor effects	0	N/A	0	N/A	0	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear and big game mitigation.	Minor effects
construction displacement effects	acres in 1-mile helicopter influence zone	N/A - all roads included in heli. const. influence zone	3,877	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear and big game mitigation.	Minor effects	624	N/A	729	N/A	729	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear and big game mitigation.	Minor effects
p. Sage and sharp-tailed grouse breeding areas and winter range	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
q. High waterfowl population areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
r. Areas of unusual scientific, educational, or recreational signficance	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect

Appendix J
Montanore 230-kV Transmission Line Minimal Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C		Altternative D		Alternative E		Alternatives C, D and E	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
s. Areas with high probability of including significant paleontological resources	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
t. Sites with religious or heritage significance/value to Indians	# sites	#sites	No sites identified	No sites identified	Ongoing tribal consultation	To be determined during consultation	No sites identified	No sites identified	No sites identified	No sites identified	No sites identified	No sites identified	Ongoing tribal consultation	To be determined during consultation
u. Water bodies	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
v. Potable surface water supplies	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
w. Active faults (for substation)	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect

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